KEYENCE

Intuitive, Auto-Teaching
Machine Vision System
CV-X100 Series

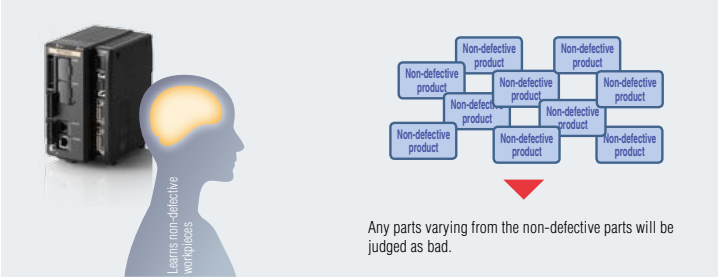
Power Meets Simplicity

CV-X100 Ver.2

Intuitive interface allows users of all levels to easily set up a robust inspection

01 Auto-Teach Inspection

Instant program creation

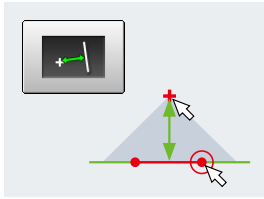

Learns non-defective workpieces
Non-defective product
Any parts varying from the non-defective parts will be judged as bad.

The Auto-Teach Inspection is a smart tool that is able to distinguish between a defective and non-defective part after a set of non-defective parts is analyzed. Stable inspection is realized as the tool will automatically recognize variations that exist in the good parts.

P.4

02 Dimensions/ Geometry Tools

Only a few clicks to high-precision measurement

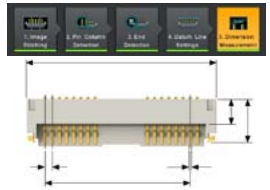


Click and choose what you want to measure. The tool will take care of the rest.

P.6

03 Connector Tools

Complex connector inspection can be set up in just a few steps



Setup is easily completed by following the guided steps. Other vision tools can also be used at the same time.

P.7

07 Utilities

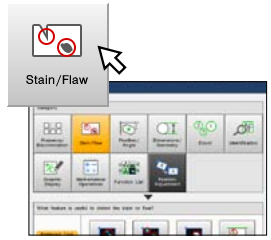
Powerful utility functions to make troubleshooting easy

The CV-X features many utilities that allow users to make easy adjustments for stable vision inspections.

P.14

08 Tool Selection Catalog based on Application

A wide range of inspection tools for use in all kinds of inspections

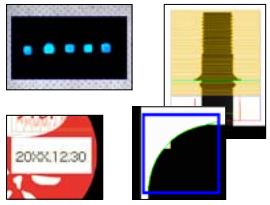


The Tool Catalog features many vision tools to solve anything from quality to measurement inspections.

P.17

04 Vision Tools

Proven vision tools provide reliable inspections

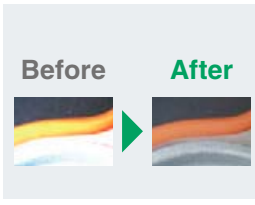


The time-tested vision tools continue to improve inspection stability.

P.8

05 Image Optimization

Get the right image with powerful image filters



Images can be enhanced by applying a variety of different image filters.

P.10

06 Customizable User Interface

Easily set up a custom screen through different predefined layouts

Built-in screen layouts allow quick development of a custom user interface that meets the actual application needs.

P.12

09 Security/Accounts

Robust security to protect program settings

Detailed passwords and restrictions on editing tools can be set to prevent unwanted access to the program.

P.18

10 User Manual Auto-Generator/ PC Software

Customized user manuals based on the actual program settings

When implementing a vision system, a custom user manual can be created that is based on the actual program parameters used for the application.

P.19

11 Communication and Control

A wide variety of communication methods compatible with existing systems

Supports communication to different PLC protocols, like EtherNet/IP and PROFINET.

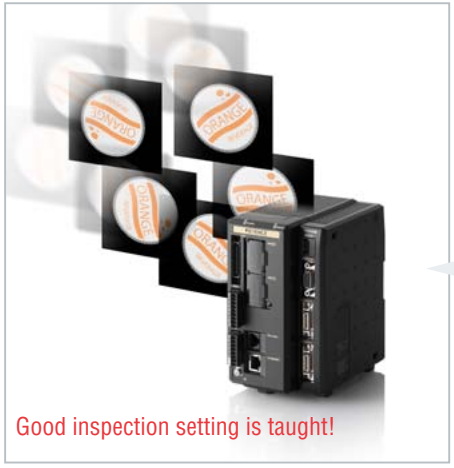
P.20

01 Auto-Teach Inspection Tool Color

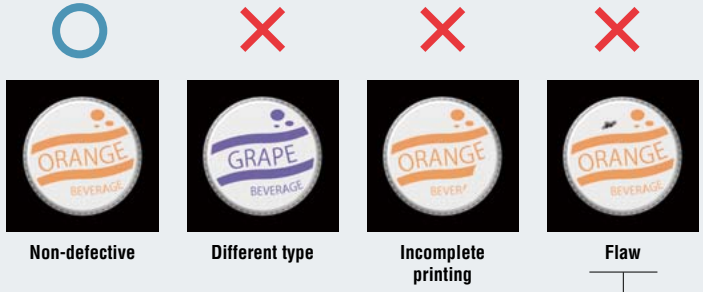
An inspection tool that is automatically setup by presenting a batch of non-defective workpieces

Inspect non-defective workpieces.

Tool settings are automatically completed!



Any parts that are different from the learned good image data will be detected as defective.


Non-defective
Different type
Incomplete printing
Flaw
Flaws that were not expected at the time of initial setup can also be detected.

Sample applications:

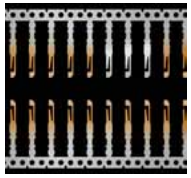
1 Setting adjustments are required due to product variations in good parts

Misarrangement inspection for boxes of tissues

Setting is completed by presenting and learning a batch of good products. Variations in the non-defective products like color, shape or lighting can be handled by a single tool allowing very stable inspection.

2 Multiple points of inspection

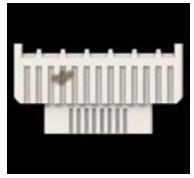
Plating defect inspection for lead frames



Complex setting with multiple inspection points can be completed with a single Auto-Teach Inspection tool. No advanced color setting is required.

3 Complex part shapes that make inspection difficult

Flaw inspection for connector housings



Since the tool will learn the entire workpiece, including the profile, there is no need to set multiple inspection regions based off the complex shape of the part.

4 The non-defective parts with some variations

Assembly defect inspection for instrument panel buttons

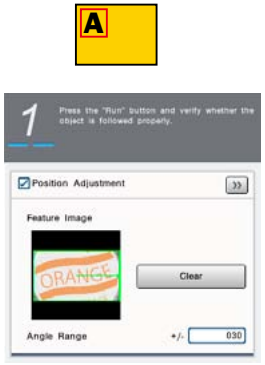
The tool learns all the variations in the non-defective parts that can be caused by different thicknesses or variances in the lighting condition and ensures proper inspection to prevent false rejection of good parts.

Three easy steps auto-teach the full pixel by pixel color information!

A 3-step procedure has been adopted for simplified setup. An additional verification step can also be performed in order to confirm whether correct settings have been made.

1 Locate Part

Draw a box around the pattern for location.

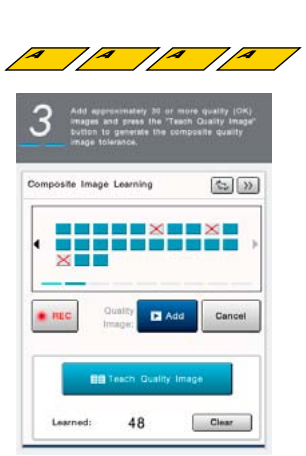


2 Inspection Region

Draw the region to be inspected.

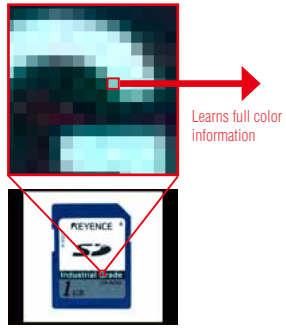
3 Auto Teaching

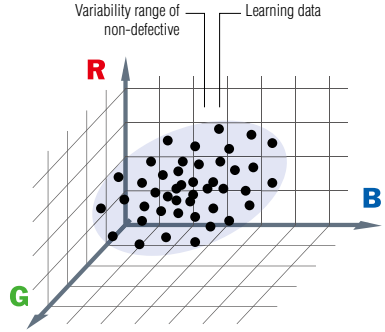
Present non-defective workpieces



Learning Full Color information

The variability range of the non-defective workpieces is determined by learning the full color information for each pixel. The auto-teach is performed to account for even subtle color differences in the non-defective parts.





Advanced detection settings made easy!

Cut Incorrect Learning

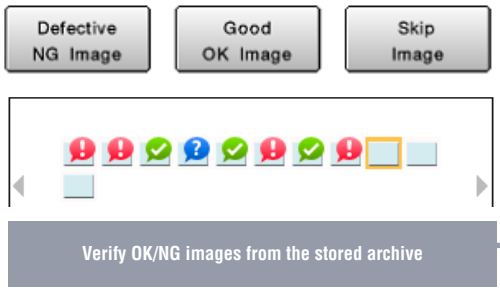
Defective workpieces that may have been mixed in with good parts during the auto-teaching mode are automatically eliminated reducing human error when setting.

Set Auto Threshold Function

Automatically calculates and sets the threshold values from the learned non-defective workpiece images.

"Auto-Teach Inspection Adjustment Navigation" ensures continuous stable detection

This utility allows users to perform "additional learning" to widen the variable range allowed for non-defective workpieces. The new image data setting can be compared to pre-stored defective images during the additional learning function to prevent unnecessary changes that could cause improper inspection.



Learns additional data for images judged as non-defective.

Compares the new setting to pre-stored defective images

Unnecessary additional learning prevented!

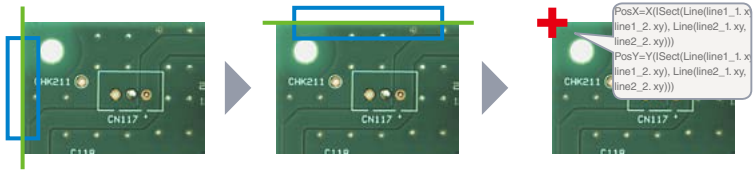
It is possible to restore the conditions before additional learning if a defective sample has been judged as OK.

02 Dimensions/Geometry Tools

High-precision measurements can be done intuitively through simple mouse operations

Conventional Systems

Vision tools and scripting must be used



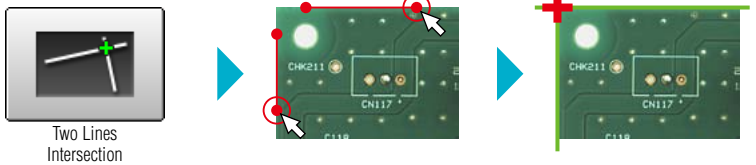
Detect a line on the left edge

Detect a line along the top edge

Calculate the intersection of the two lines using calculations

CV-X100 Series

Simply point and click



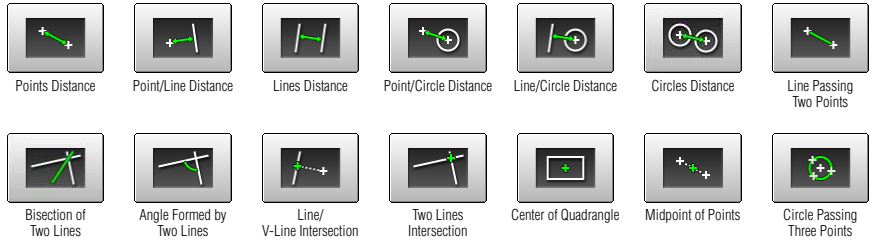
Two Lines Intersection

Select to find the intersection of two lines

Draw a line on the top and left edge, close to where the edges should be

The lines are found and the intersection is automatically detected!

Simply choose the dimension you are looking for



Points Distance | Point/Line Distance | Lines Distance | Point/Circle Distance | Line/Circle Distance | Circles Distance | Line Passing Two Points

Bisection of Two Lines | Angle Formed by Two Lines | Line/ V-Line Intersection | Two Lines Intersection | Center of Quadrangle | Midpoint of Points | Circle Passing Three Points

Easy scaling with any image size

Scaling

If a tool needs to output in units other than pixels, scaling can be applied.

1 Measure the target.

2 Input the measured, real value of the target.

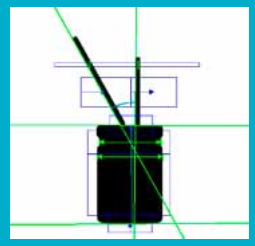
3 Convert pixels to measured value and display.

312.8 px

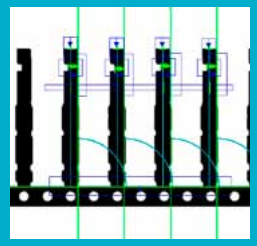
10.000 mm 0.39"

APPLICATION

Even complex objects such as the ones below can be measured quickly.



Electronic components



Stamped parts

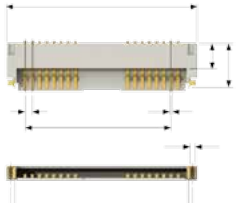
Labels

03 Connector Tools

Guided setup of complex connector inspections

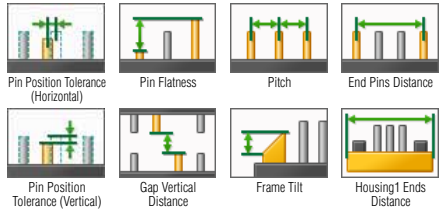
The CV-X100 Series makes setup easy

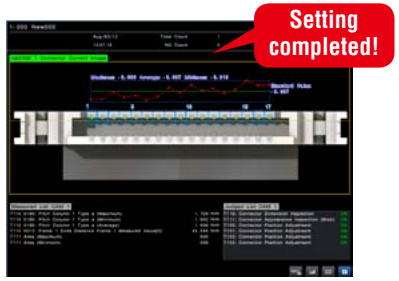
Example: Connector inspection that requires various items to be inspected for each product type and shape



Follow the steps to set up the tool

Select different measurement tools to inspect the connector



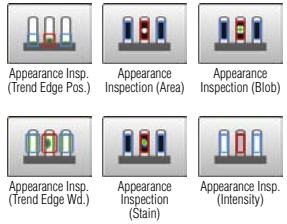


Inspection can also check for surface defects

Aside from the measurement tools, other vision tools can be added to check for defects like resin overlaps, short shots, and other flaws on the connector housing. Simply add these tools to the existing inspection for a complete solution.

Connector appearance inspection

Choose from a wide range of vision tools to inspect for surface defects on the pins. These vision tools will automatically duplicate region settings on other pins after setup is done for one to significantly reduce setup time!



Connector adjustment menu

Connector specifications may change. If a connector with a different number of pins needs to be inspected, you can simply run the Connector Adjustment Menu which will streamline the changeover process.

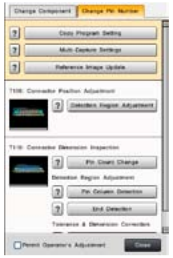
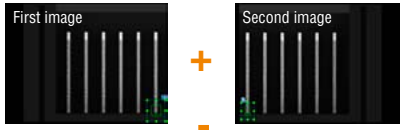
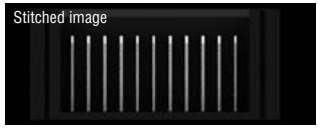


Image stitching

Large connectors may require several image captures to view the whole connector. The images can be easily stitched into one image for easy setup of the tools.

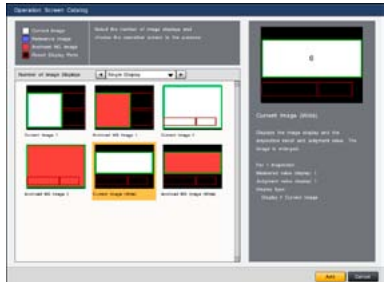




Just specify a pin or stitching point

Connector-dedicated operation screen

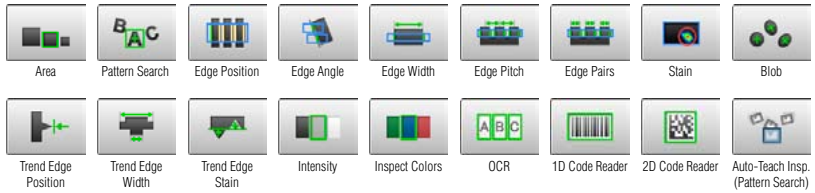
The operation screen most suitable for the connector inspection can be created just by selecting from the catalog.



04 Vision Tools

A complete toolset to solve a variety of applications

A full set of vision tools are available.



Stain

KEYENCE original surface inspection tool

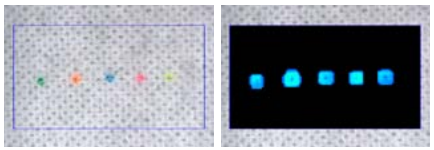
The Stain tool can find defects such as stains and scratches by comparing the adjacent group of pixels and looking for a relative change in contrast. It provides a consistent and reliable way to find surface defects.

Flaw detection of resin cap

A small flaw is found on the side of the resin cap.

The tool ignores uneven illumination of the round surface but detects the flaw.

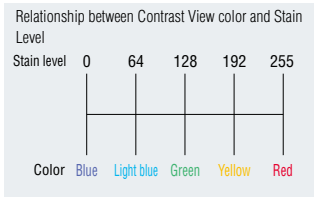
Flaw detection for non-woven fabric cloth



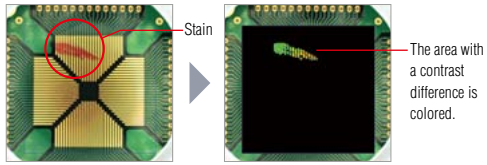
Fine color processing directly processes color information exactly as the color camera captures it. This is ideal for detecting stains on sheets, films and non-woven cloths where defects can appear in any color.

Contrast View Display

Using a range of colors, the Contrast View visualizes stains that are found. The Stain tool works off of relative contrast differences, so when there is a more severe flaw, the more red the Contrast View gets. This is updated in real time so it is easy to see the defect position.


Relationship between Contrast View color and Stain Level
Stain level 0 64 128 192 255
Color Blue Light blue Green Yellow Red

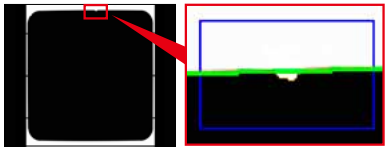
Bad mark detection on PCBs



Trend Edge Stain

Optimized for edge defects

Trend Edge Stain detects the flaws on the profile of the part. The profile is automatically extracted just by setting the inspection region around it. In addition to geometric shapes such as circles and straight lines, the oval or the profile of an object with complex edges can still be detected.



A reference line is made based off of the found edge. Any deviations away from this line will be recognized as a defect.

A defect can be detected on a curved edge as well.

Even if the target shape changes from inspection to inspection, the free curve setting will still find the complex profile of the part. With each inspection, the Trend Edge Stain tool will still map the best fit curve and find any flaws that deviate away from this curve.

Loose cable winding inspection

OCR

Stable reading even with variations in the image

The built-in OCR function allows users to read strings by setting the region of interest and registering the characters. The OCR tool can have dynamic inspections so when reading strings that change on a daily basis, it will update the tolerance of the OCR tool automatically.

Capable of recognition without influence of the background printing

The string is printed on an area of the package where there is a design.

Easy setup by following the steps

The guided tool set up helps users extract out just the text.

1D/2D Code Reader

Simultaneous code reading and inspections

Reads the 1D/2D code printed on the target workpiece. Since the code reading is built in, there is no need for extra readers, saving space and cost.

"Verification" function is supported for 2D codes

DataMatrix QR code

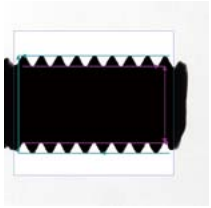
Other inspections are performed simultaneously while the 2D code is read.

Trend Edge Position/Width

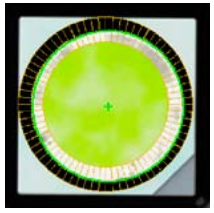
High precision edge detection

Simply by adding an inspection region, the profile of the edge can be detected. By detecting many edges along the inspection region, this tool can accurately measure features like max/min/average width, max position and peak-to-peak width. The tool can also draw a best fit line or circle according to the found profile.

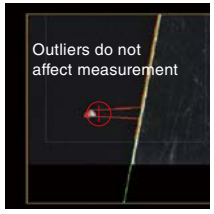
Peak-to-peak width



Best fit circle

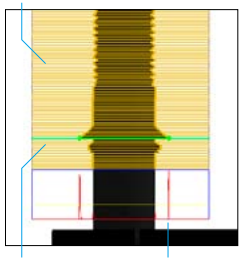


Best fit line



Bolt measurement

Trend Edge Width can measure the maximum diameter of the thread. Each found edge is displayed in yellow and the green indicates the widest section.



The maximum diameter is detected. The edge graph aids in tool setup.

On-Screen Graphics

Graphical displays can be added to the screen

Different shapes like points, lines, and circles can be drawn using this tool. Since it is also possible to reference values measured by tools, various advantages are offered such as an improved visibility of a detected location on the screen.

Graphical display

Scale display

A scale can be displayed as well. Measurement values can be easily seen after conversion from pixel values.

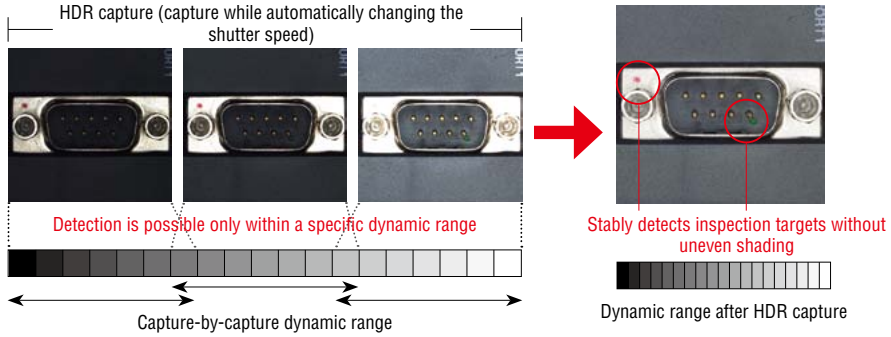
05 Image Optimization

Ideal imaging to ensure stable inspection

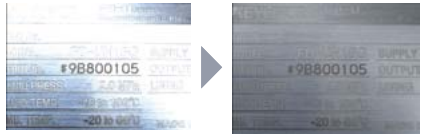
HDR

High dynamic range (HDR) creates evenly exposed images

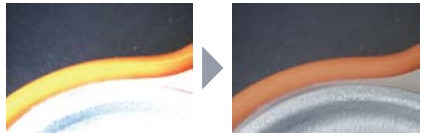
HDR captures multiple images while automatically changing the shutter speed and composes them at high speed to generate an image without highlights and shadows. Clear images ideal for processing can be captured even when on-site capture conditions vary or inspection targets contain uneven shading.


HDR capture (capture while automatically changing the shutter speed)
Detection is possible only within a specific dynamic range
Capture-by-capture dynamic range
Stably detects inspection targets without uneven shading
Dynamic range after HDR capture

Glare removal



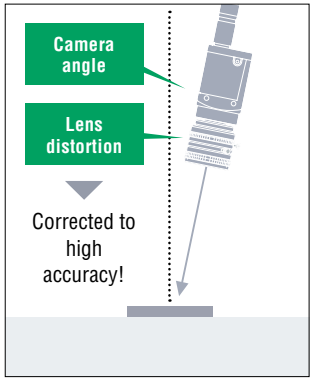
Lighting variation removal



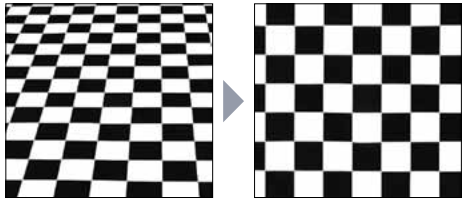
Calibration

Removes effects of lens distortion or angled camera

Removes effects of changes in the capture conditions due to installation- and hardware-related factors such as “camera angle” and “lens distortion”. This function offers consistent capture conditions, including replicating the same capture conditions for line deployment and eliminating effects of restrictions in the installation environment.

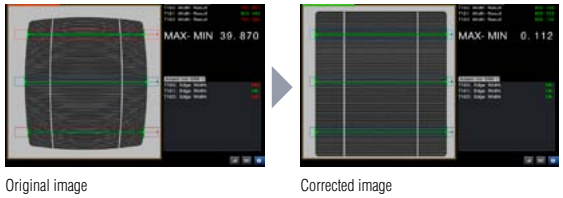


Corrects angular distortion



Corrects camera tilting that may occur during installation. This is also effective when a camera is installed at an angle due to installation restrictions.

Corrects lens distortion



Addresses a problem where measurement results differ between image center and edge due to lens distortion.

Image capture conditions

Ideal capture configurations can be selected according to inspection

Multiple image capture

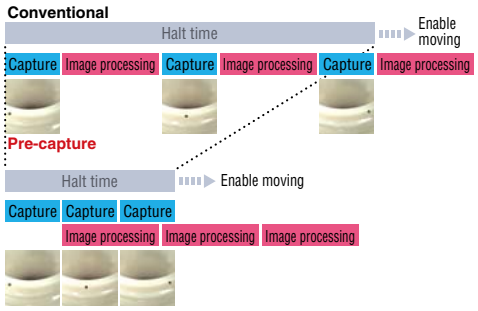
Multiple images are captured in one measurement cycle. Images are captured with different lighting conditions with all the inspections and output results completed in a single process.

Coaxial light clearly shows direction marks on corners.

Low angle light clearly shows print and lead.

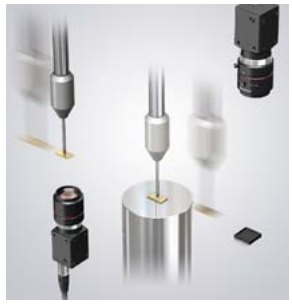
Image buffer

Images can be captured at high speeds and stored in the buffer while previously captured images are simultaneously processed in the flowchart for optimal processing performance. This allows the vision system to continue capturing images while an image is being processed.



Asynchronous trigger

The CV-X100 series can receive asynchronous triggers with multiple cameras. This allows a multi-camera system to be triggered without a pattern, allowing efficient inspection performance.



Conventional

The index stopping time had to be extended to align timing or 2 controller units had to be used.

CV-X

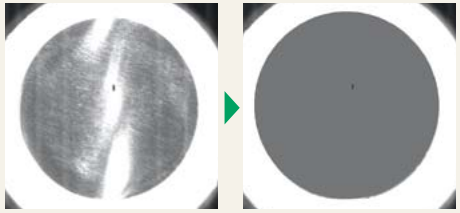
Because there is no latency for image processing, operation without stopping the equipment is possible even with a single controller.

Image enhancements for stable inspection

Shading correction

Shading correction is a real time filter that evens out any large random shadows or glare on a target surface, leaving behind smaller defined points which are often associated to being flaws or defects.

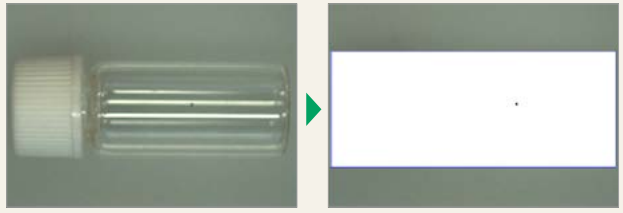
Stain detection on the bottom of a can



There are stains among the hot spots that occur at random.

Hot spots are canceled out and only the defect remains.

Stain inspection of a clear bottle



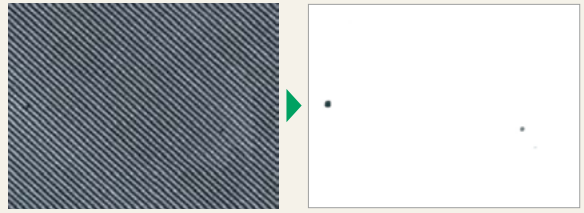
There is a flaw in the unevenly lit bottle.

After shading correction, the flaw is easily seen.

Blurring by direction

The blur filter can blend background patterns or image noise to allow only the defects to be seen.

Foreign particle detection on a striped pattern



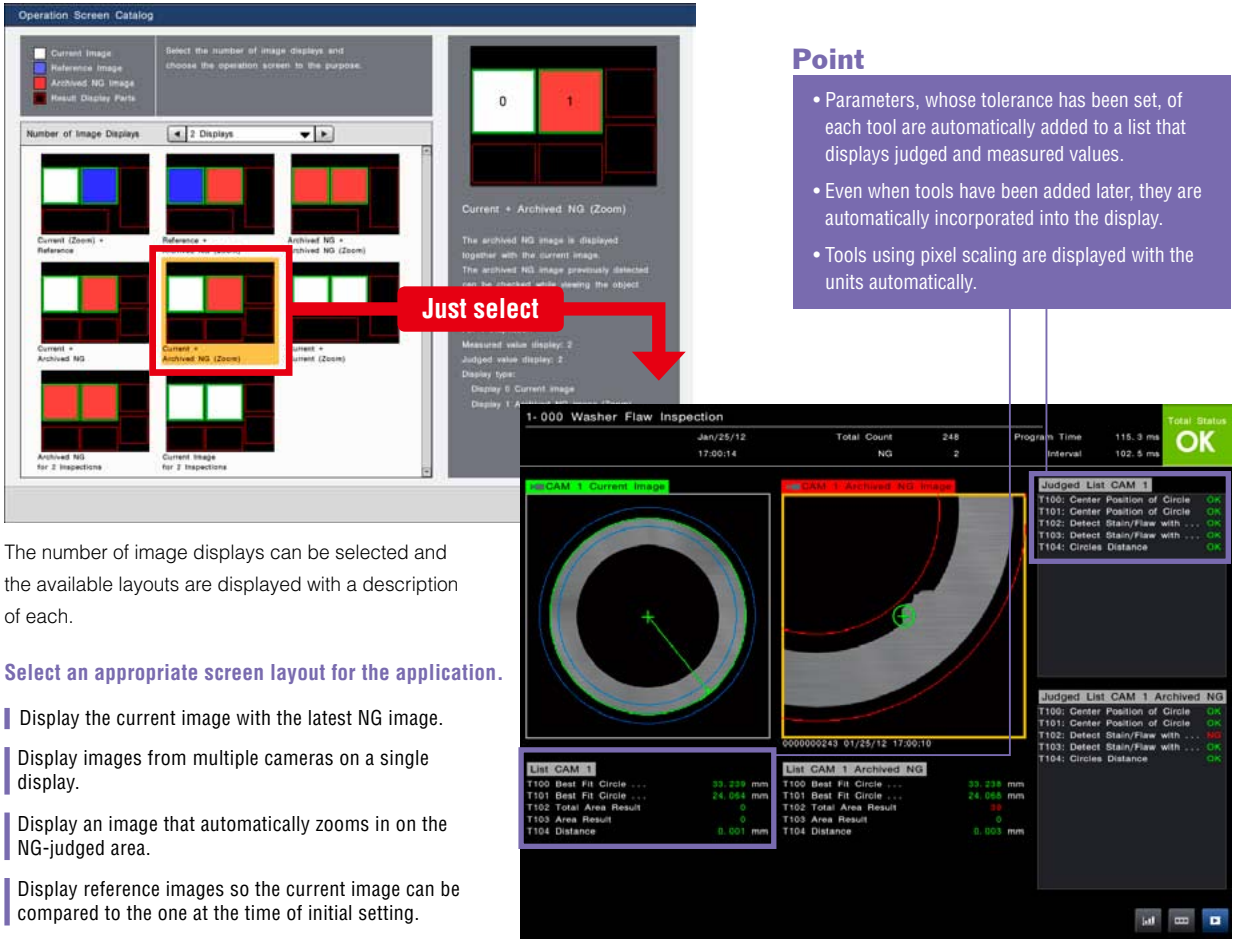
There are foreign particles within the striped pattern.

Extracts foreign particles only with a combination of blurring and shading correction.

06 Customizable User Interface

No complicated settings are required, simply select a graphical template and adjust

The Operation Screen Catalog includes many preset screen layouts to choose from



The number of image displays can be selected and the available layouts are displayed with a description of each.

Select an appropriate screen layout for the application.

- Display the current image with the latest NG image.
- Display images from multiple cameras on a single display.
- Display an image that automatically zooms in on the NG-judged area.
- Display reference images so the current image can be compared to the one at the time of initial setting.

Point

- Parameters, whose tolerance has been set, of each tool are automatically added to a list that displays judged and measured values.
- Even when tools have been added later, they are automatically incorporated into the display.
- Tools using pixel scaling are displayed with the units automatically.

* Microsoft is a registered trademark of Microsoft Corporation in the United States and other countries.

Intuitive operation when creating program settings

Tool bars displaying thumbnail previews

All the inspection tools that are added are displayed in the thumbnail image bar, so it is very easy to understand the regions of the part that are being inspected.

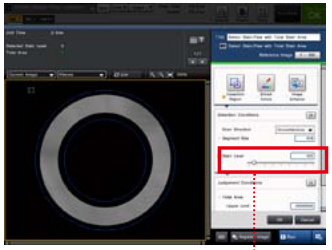
Intuitive operation using a mouse

The icon-based, easy-to-understand GUI enables intuitive operation with a mouse. All program settings including adjusting the inspection regions are completed directly using the mouse.

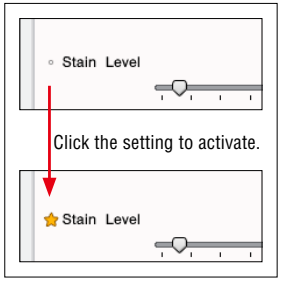
Custom menus streamline setting adjustments to a single click

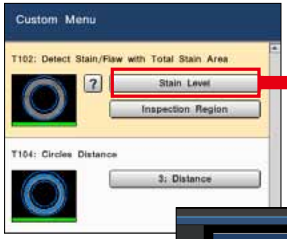
During inspection operations, there are some parameters that may need to be adjusted on a regular basis. An optimal operator menu can be created so that users only see selected settings. This makes adjustments very easy and prevents unwanted changes to other parameters in the program.

Select the desired parameters during setup



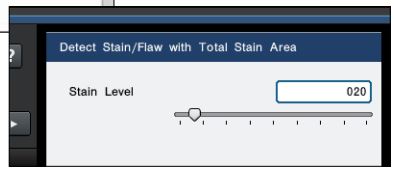
Flag the parameters that need to be adjusted often by the user.



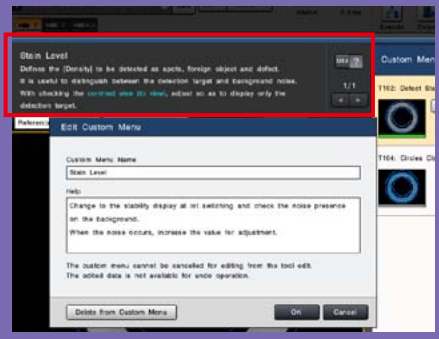


The parameters that are flagged can be opened directly by the operator...

A specialized menu that contains only the parameters required for operation is complete!



Operation comment function included



Fully customized comments can be displayed in the help field of the custom settings menu. This can further guide the user on making the correct adjustments to the program.

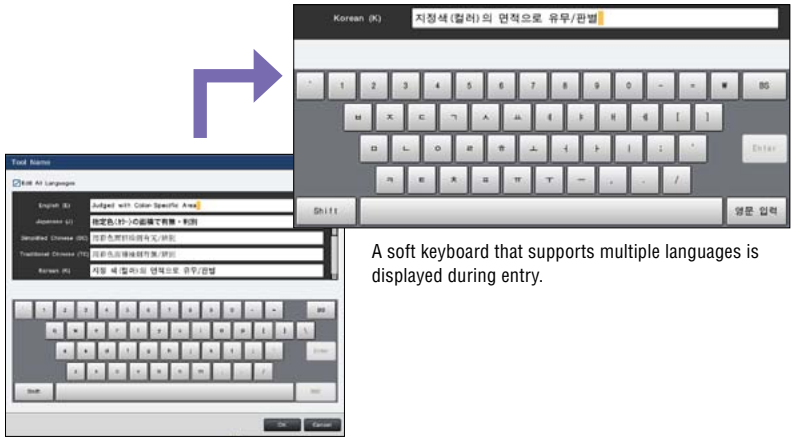
Ten languages supported

Multi-language input system incorporated

The character input function supports the use of multiple languages at the same time. It is possible to perform direct input for each language separately for items such as tool names or the custom menu comments without having to switch the system language.

English	Utility / Run Mode / Total Status OK	Italian	Utility / Passa alla modalità esecuzione / Stato generale OK
Simplified Chinese	实用功能 / 至运行模式 / 综合判定 OK	Korean	유틸리티 / 운전 모드로 / 종합 판정 OK
Traditional Chinese	實用功能 / 至運轉模式 / 綜合判定 OK	Spanish (Mexican)	Utilidad / Ir al modo de ejecución / Estado total OK
French	Utilitaire / Passer en mode exécution / Statut total OK	Thai	ยูทิลิตี้ / สู่โหมดดำเนินงาน / การตัดสินรวม OK
German	Erweit. / Wechsein zum Run- Modus / Gesamtstatus OK	Japanese	ユーティリティ / 運転モードへ / 総合判定 OK

The character string input on the controller also supports multiple languages



A soft keyboard that supports multiple languages is displayed during entry.

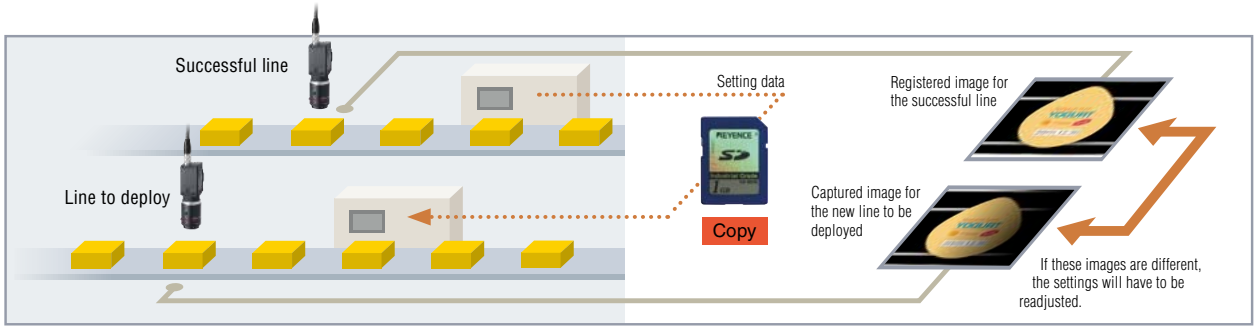
07 Utilities

Easy to use utility functions allow users to continuously maintain consistent and stable vision inspections

The Camera Installation Replication function enables a consistent image capture environment throughout the life of the inspection or to duplicate an existing inspection line condition

Conventional

The inspection is being expanded by adding a new production line. It is desirable to just copy the settings of the current line, but it is difficult to set the camera mounting exactly the same which may lead to many program setting adjustments.

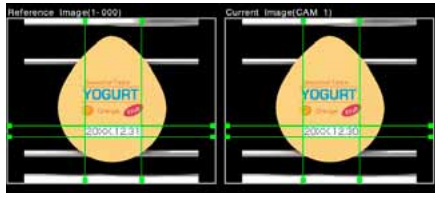

Successful line
Setting data
Registered image for the successful line
Line to deploy
Copy
Captured image for the new line to be deployed
If these images are different, the settings will have to be readjusted.

Camera Installation Replication

The camera installation of the current line can be easily replicated

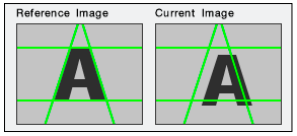
The current camera image can be compared to the original registered image. This facilitates the deployment of new production lines to match that of successful lines or to maintain consistency over time with an inspection to make sure the current image capture condition is always the same as it was initially set.

Position Adjustment Tool

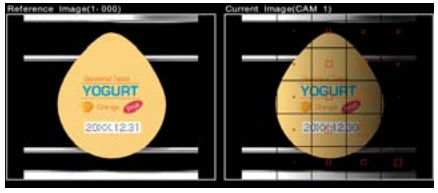


Successful line Line to deploy

Using the guidelines on the screen, the position of the camera can be adjusted so that the current image position matches that of the stored image condition.



Brightness Adjustment Tool



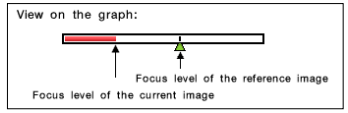
Successful line Line to deploy

Areas where the current brightness differs from the reference image are clearly indicated in order to make adjustments.

Focus Tool

Successful line Line to deploy

The focus condition of the registered image is displayed as a bar graph and compared to the current image in order to make them match as closely as possible.



Tool Adjustment Navigation allows all users to easily make setting adjustments

Conventional User is not sure where to start making adjustment

- It is uncertain which tool needs to be adjusted.
- A position adjustment failure may be the cause of the false judgment.
- It is unclear which images to use for correcting the tool setting.

Tool Adjustment Navigation

Navigation for accurate and optimal adjustment

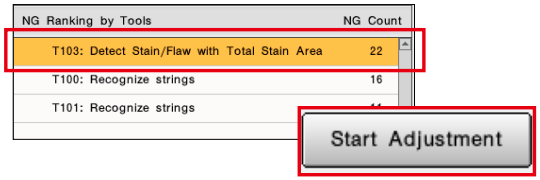
When the utility is launched, navigation starts after analyzing archived images

Navigating adjustment procedures when non-defective workpieces have been mis-detected

Adjustment Navigation Flow
1 Sort OK/NG
Extract the images which should have been judged as OK from the NG judged images and try to correct the false judgment condition in the following steps.
2 Check Position Adj.
The position adjustment failure may cause the false judgment. Extract the images where the inspection region is not properly following the detection target.
3 Correct Position Adj.
Adjust the position tool so as to correct the position adjustment on the image extracted in the previous step.
4 Adjust Tool
NG OK
Adjust the target tool to be properly judged as OK for each good image.

Example of setting procedures :

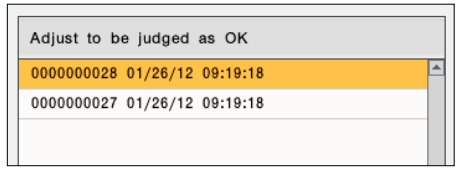
1 Select a tool that has a high NG count from the NG ranking list and then start adjustment.



2 Sort out the images that should be judged as OK.

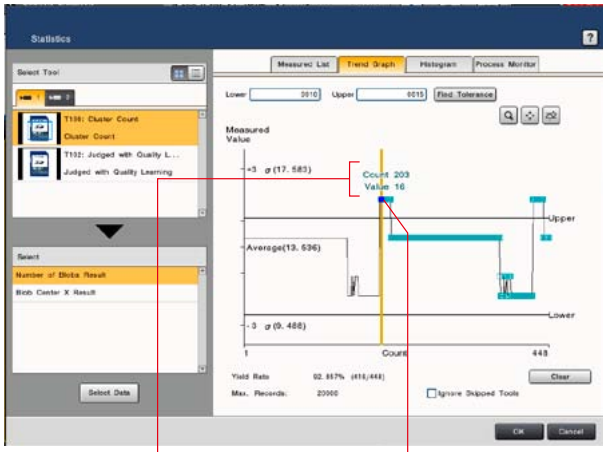
3 When position adjustment is used, it will be automatically checked to confirm proper setting of the adjustment tool.

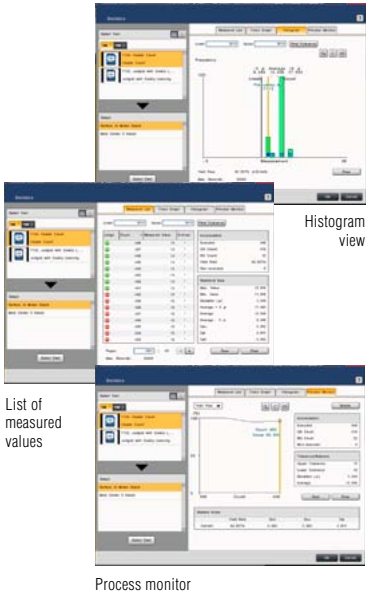
4 Only the images that need to be adjusted with the selected tool are extracted.



Managing & maintaining the inspection process using statistics

Up to 20,000 data points can be recorded directly on the controller with the statistics function. Minimum, maximum, average, standard deviation, NG count and yield rate values can all be verified in real time. The data can also be displayed as a trend graph or a histogram. Process capability index (Cpk) is available for further analysis of the inspection.





Histogram view

List of measured values

Process monitor

Vertical cursor

Displays the measured values and the total count for the selected cursor position.

Image save mark

■ Images stored in the archive are linked to the data points and can be checked by clicking.

Image Archive / Image Output

Each inspection image can be archived within the main buffer of the controller. It is also possible to output images from the archive to an external device like an SD card, PC or FTP server.

Archived images are displayed as thumbnails on the image strip

Just click the image on the image strip during setup to automatically execute a retest using that image.

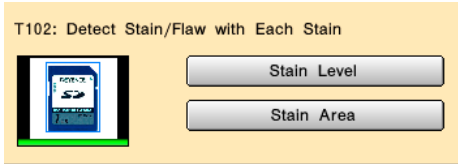
Maximum number of images* that can be saved according to camera type

Camera type	Number of images saved to the internal memory	Number of images saved to the 4 GB SD card
Monochrome 240,000 pixels	1001	16284
Color 240,000 pixels	992	5490
Monochrome 310,000 pixels	489	13071
Color 310,000 pixels	484	4396
Monochrome 1 megapixel	233	4056
Color 1 megapixel	224	1356
Monochrome 2 megapixel	105	2114
Color 2 megapixel	97	706
Monochrome 5 megapixel	35	816
Color 5 megapixel	27	272

*These are typical values in regard to saving to the internal memory when a single camera is connected using CV-X172 and when storage conditions for archived images are set to "total status NG". Typical values with a single connected camera when saving to a 4 GB SD card.

Tolerance overwrite function

Judgment conditions and stain levels can be adjusted real-time during operation without the need to stop the production line.

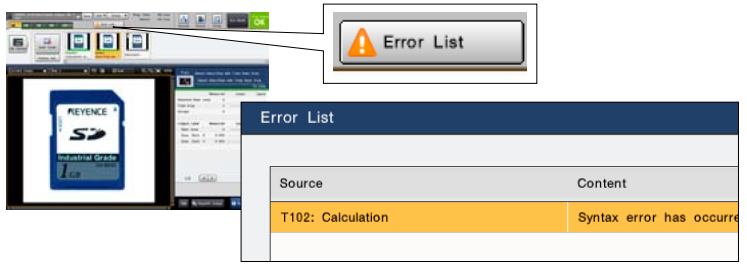


Judgement conditions sharing function

Judgement conditions can be shared between tools when the same inspection processing is required on multiple points of the target. Thus, one adjustment is reflected to the other tools.

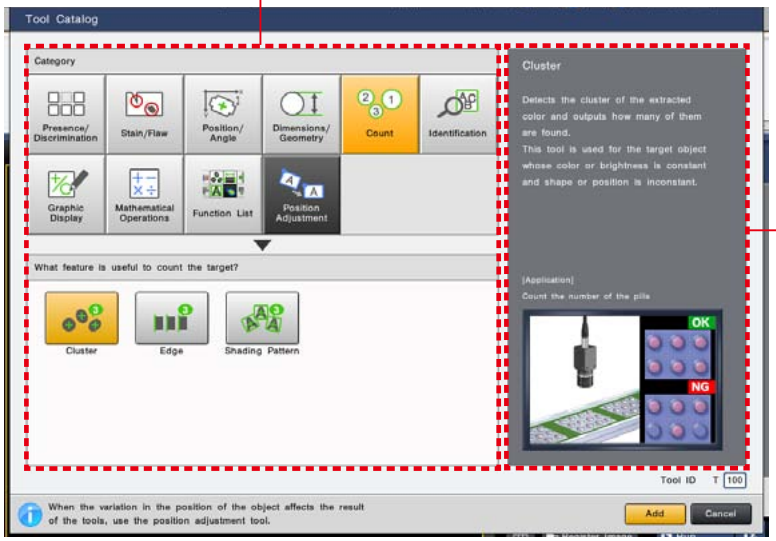
Error notification

Setting errors can be displayed in a list. The error can be selected from the list and the user will be automatically linked to the corresponding setting that caused the error.



08 Tool Selection Catalog based on Application

Just select the desired application type, instead of the traditional tool name



Tool catalog

The tools have been catagorized according to application, based on common industry inspection applications. It allows the user to intuitively find the best tool for their application.

Application navigator

A description and typical application for each tool is displayed for optimal selection of the correct inspection type.

Intuitive menu organization

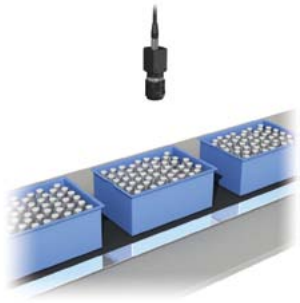
The setting menus are arranged so that they are very graphical and easy to understand in order to help guide the user through the proper setup of each tool.

Help guide function

A help guide is incorporated that includes a description of the parameter that is being adjusted for a clear understanding on what is being changed.

APPLICATION

When setting to count the expected number of workpieces in a case...



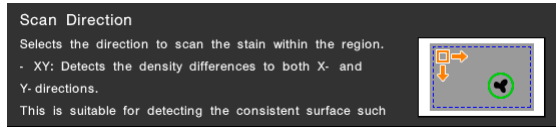
Conventional

Inspection is difficult to setup as the user cannot reliably determine which algorithm is the best choice.

Tool catalog

Just select the inspection category from the tool catalog

Counting tools are outlined in the “Count” category so there is no confusion.

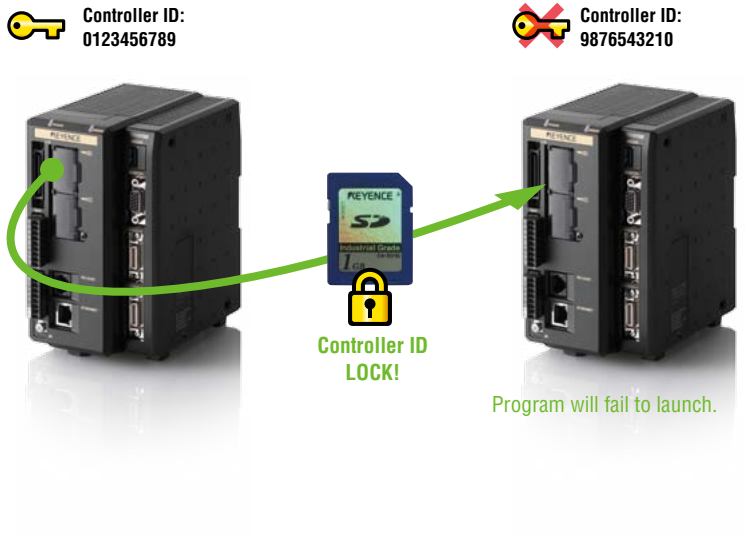

Scan Direction
Selects the direction to scan the stain within the region.
- XY: Detects the density differences to both X- and Y- directions.
This is suitable for detecting the consistent surface such

09 Security/Accounts

Multiple security options are available to protect program data

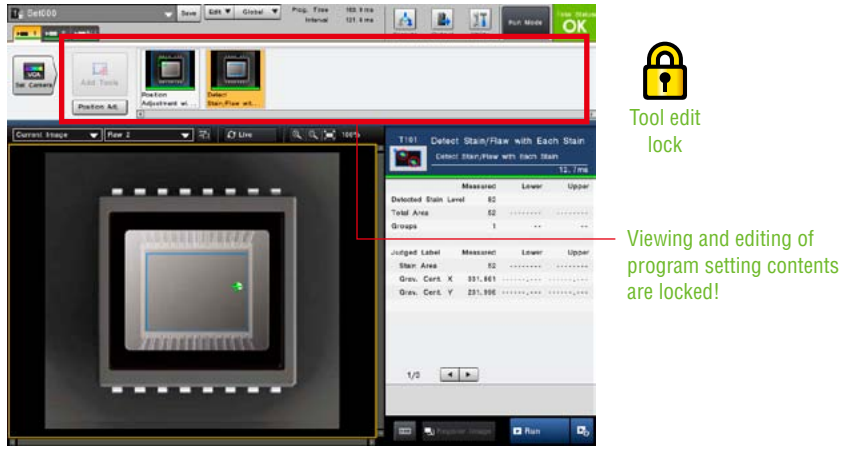
Controller ID lock

The program can be locked so it only runs on a certain CV-X controller. This prevents copied or original versions of the program to be used in other controllers without permission.



Tool edit lock

The Tool edit lock function will prevent users from viewing or making unwanted changes to set tool parameters.



Password settings

For powerful protection, up to 32 characters can be used for the password.

Account settings ~Operating setting protection~

An Administrator, Operator, and User account are available on the CV-X to prevent unauthorized operation of the controller.

Admin	All operations are possible.
Operator	Custom menu operation, change programs, and saving are possible.
User	Viewing only.

Changing between accounts can be done directly on the controller.

10 User Manual Auto-Generator/PC Software

Full-featured PC software

Auto-generate a user manual customized to the actual program settings

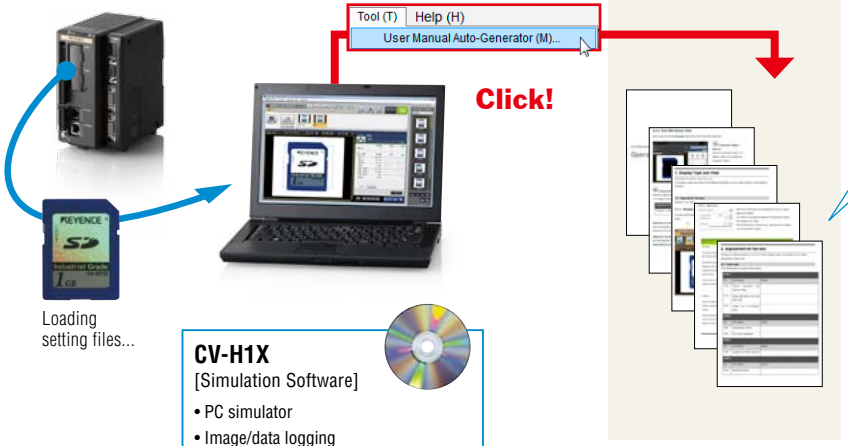
Conventional

An operation manual is required as a reference for a user with the system installed.

The standard manual is too big and extensive. It makes troubleshooting time consuming and frustrating.

User manual auto-generator

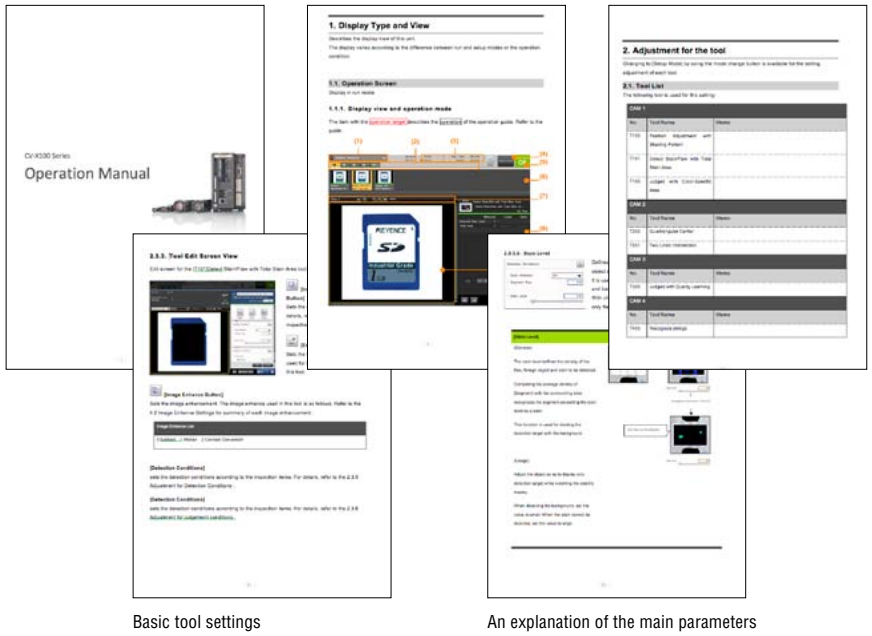
Customized manual creation in a single click!



CV-H1X
[Simulation Software]

- PC simulator
- Image/data logging
- User manual auto-generator
- Setting file upload/download

Example of auto-generated user manual



Multiple language support

User manuals can be created in ten languages.

MS Word output

Outputs in Microsoft Word format. This makes it possible to further customize the manual like adding comments.

Tool setting tips

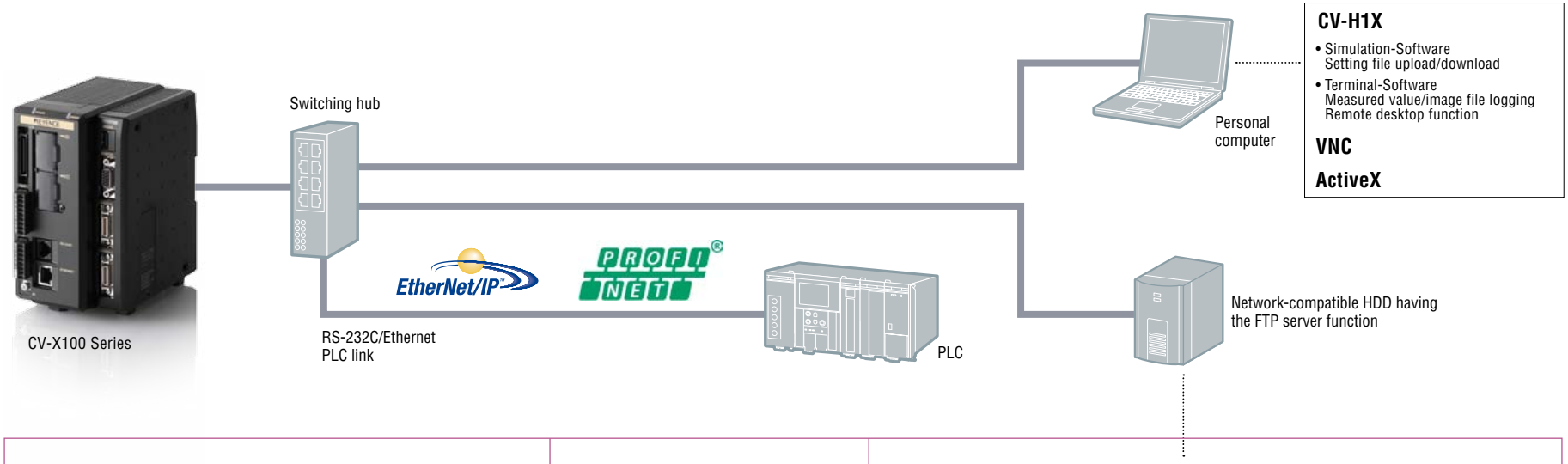
It is possible to insert Tips describing how each tool's parameter is typically adjusted.

11 Communication and Control

A wide variety of communication methods compatible with existing systems

Communication interface

The system supports a PLC Link function to link to many different PLC manufacturers as well as EtherNet/IP and PROFINET protocols. Remote control connection via a PC is possible as well as image/result logging to an FTP server.



PLC link

PLCs made by several manufacturers can be linked via RS-232C/Ethernet.

Supported PLC manufacturers:

KEYENCE: KV Series
Omron: SYSMAC Series
Mitsubishi Electric: MELSEC Series
YASKAWA Electric: MP Series

EtherNet/IP- and PROFINET-compatible

EtherNet/IP PROFINET

Communication monitor function

The system is equipped with several communication monitor functions that can be used to troubleshoot and confirm communication between the devices including EtherNet/IP and PROFINET.

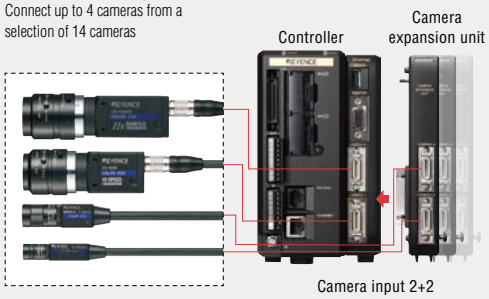
FTP output function

Supports image & measurement value output to an FTP server. A multitude of image data can be saved directly to a high-capacity HDD that supports the FTP server function.

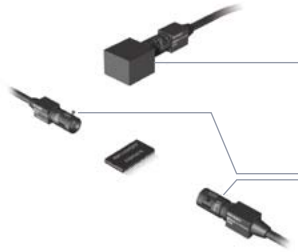
Multi-camera, simultaneous acquisition system

A total of 14 types of cameras can be mixed for use.
For example, it is possible to use a monochrome camera for one side of the part but use a color camera for a different side. Up to 4 cameras, including 5 megapixel cameras, can be connected at once. This allows for a variety of applications to be solved.
(*The expansion unit can be connected to the CV-X152x/CV-X172x)

Multi-Camera System
Connect up to 4 cameras from a selection of 14 cameras



Application example



CAM 1
Molding flaw inspection, print inspection
2 megapixel compact color camera + side view unit

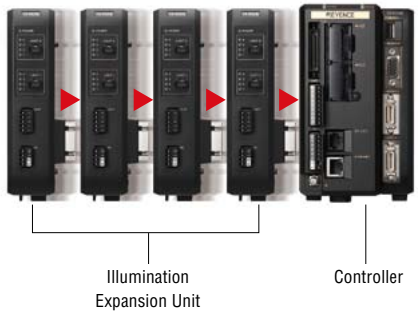
CAMs 2, 3
Coplanarity inspection
2 megapixel monochrome compact camera

When performing simultaneous inspection with multiple cameras, it is possible to reduce total system cost by selecting the best cameras according to the application.

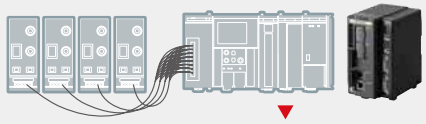
Illumination Expansion Unit

Easy light control without cumbersome wiring

Up to 4 lighting expansion modules can be connected to the main controller. Each unit has 2 lighting connections (connector and terminal style) so up to eight 12 or 24 VDC light can be connected.



Problems with conventional methods:
PLC control via a number of I/O is necessary



I/O unnecessary,
and PLC settings are unnecessary!

Application example

Brightness presets for each inspection setting

Automatic light intensity adjustment for each product type

When the product being inspected changes, different lighting settings may be required to capture the optimum image. It is possible to automatically change to the light intensity when a different product is inspected.

Brightness value: 127

The optimal brightness for workpieces with low reflectivity...

If left unchanged

Brightness value: 127
If the brightness volume remains the same, the captured image may not be optimal for inspection.

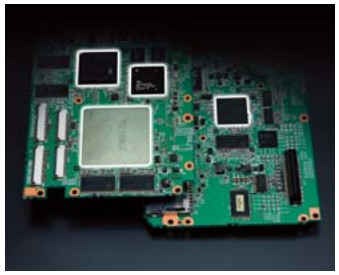
Switched to preset

Brightness value: 80
By presetting the best brightness volume according to the product type, equipment changeover will be completed with ease.

Ultra high-speed/parallel processing, “3+1” processor

Fastest in its class

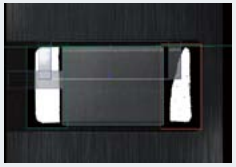
KEYENCE always strives to create the industry standard and best performance for ASIC/CPU based vision systems. Placing a heavy emphasis on the benefits of parallel processing and processor architecture has helped keep KEYENCE at the forefront of technology. In addition to the “A.C.E.II” (color image processing engine), KEYENCE has achieved stable, high-speed processing by combining 2 DSPs (image processing and screen display) and a RISC-CPU for overall control and communication into one dedicated hardware package.



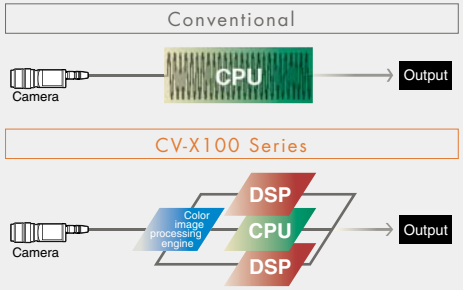
Example of ultra high-speed processing

Electric component appearance inspection trigger interval in 3 ms

Using a high-speed 310K pixel color camera set to capture 240 lines using position correction, binary area & color defect inspection.



Comparison with conventional processing processes

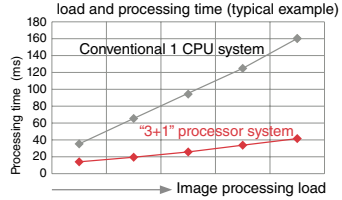


Achieves high-speed inspection by sharing the image processing task between multiple processors.

A comparison of processing time between the “3+1” processor system and a 1 CPU system

*The image processing load is increased under the following conditions:
- Detailed pattern search or stain inspection
- Increasing the amount of image enhancement.
- Increasing the amount of camera pixels.

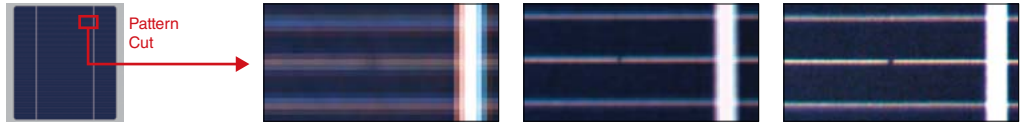
Relationship between image processing load and processing time (typical example)



14 types of cameras that can be chosen by application

Whether the application calls for high quality inspection with a color megapixel camera, fast processing inspection with a 7x high-speed camera, or mounting a compact camera in a tight environment, the wide variety of CV Series camera line-up can provide the ideal solution.

Differences in stain detection capabilities depending on the difference in the number of pixels



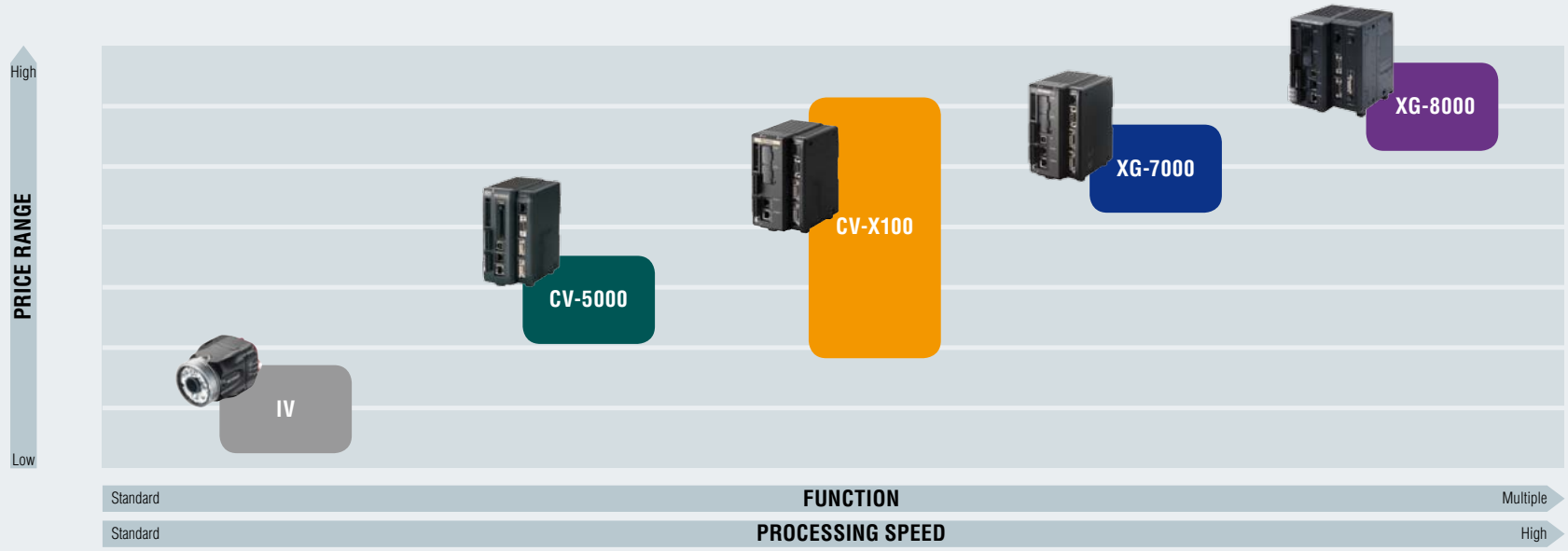
[310,000 pixels]
Detection is absolutely impossible.

[2 megapixel]
The image is blurred and the field of view must be narrowed.

[5 megapixel]
Accurate judgment possible.

	5 megapixel camera series	2 megapixel camera series			310,000 pixels camera series		
	11x 5MEGA DIGITAL	7x MEGA DIGITAL	MEGA DIGITAL	SUPER-SMALL DIGITAL	7x HI-SPEED DIGITAL	HI-SPEED DIGITAL	ULTRA-SMALL DIGITAL
Model	CV-H500M CV-H500C	CV-H200M CV-H200C	CV-200M CV-200C	CV-S200M CV-S200C	CV-H035M CV-H035C	CV-035M CV-035C	CV-S035M CV-S035C
Specs	11 x Monochrome 11 x Color	7 x Monochrome 7 x Color	Monochrome Color	Compact monochrome Compact color	7 x Monochrome 7 x Color	Monochrome Color	Compact monochrome Compact color
Capture range	2432 x 2050 pixels 2432 x 2050 pixels	1600 x 1200 pixels 1600 x 1200 pixels	1600 x 1200 pixels 1600 x 1200 pixels	1600 x 1200 pixels 1600 x 1200 pixels	640 x 480 pixels 640 x 480 pixels	640 x 480 pixels 640 x 480 pixels	640 x 480 pixels 640 x 480 pixels
Transfer time	61.2 ms 61.2 ms	29.2 ms 29.2 ms	59 ms 59 ms	59 ms 59 ms	4.7 ms 4.7 ms	16.7 ms 16.7 ms	16.7 ms 16.7 ms

Vision system lineup



Providing lineups comprising of units for various purpose from building a full-scale vision system to detection or existence check at a reasonable price.
The lineup covers the needs of all customers to resolve the every issue that appears on-site.

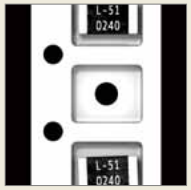
FUNCTION DETAILS

			IV	CV-5000	CV-X100	XG-7000	XG-8000
Camera	Maximum No. of cameras		1	4	4	4	8
	No. of compatible cameras		8	14	14	14	17
	Camera resolution support	310,000 pixels	✓	✓	✓	✓	✓
		2 megapixels	—	✓	✓	✓	✓
		5 megapixels	—	✓	✓	✓	✓
	Color camera support		✓	✓	✓	✓	✓
	Line scan camera support		—	—	—	—	✓
Controller	Image processing engine		Single core	Single core (High-speed type)	Single core (High-speed type)	Single core (High-speed type)	Multi core
	Processing speed		Standard	High-speed	High-speed	High-speed	Ultra high -speed
	I/O		✓	✓	✓	✓	✓
	Light extension unit support		—	✓	✓	✓	✓
	Touch screen support		—	—	—	✓	✓

Presence/Discrimination

IC presence inspection in carrier tape

OK product



Missing IC

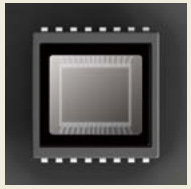
Capacitor print quality inspection

OK product

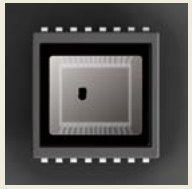
NG product

Stain/Flaw

CCD flaw inspection

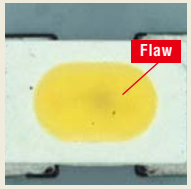


OK product

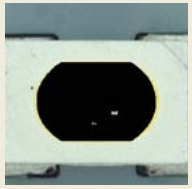


NG product

LED appearance inspection



NG product



Contrast image

Position/Angle

Positioning switch terminal

OK product

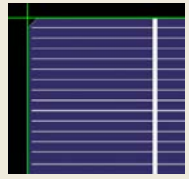
NG product

Capacitor lead inspection

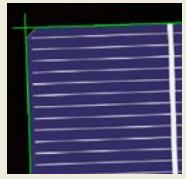
OK product

NG product

Positioning of solar panel



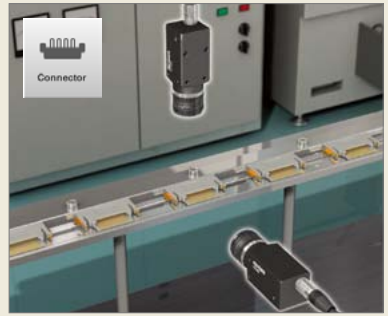
OK product



NG product

Connector

Connector coplanarity inspection



OK product

NG product

Presence/Discrimination

False assembly inspection for fuse boxes

OK product

NG product

Product verification inspection

OK product

Wrong type

Stain/Flaw

Flaw inspection for steel plates

OK product

Image after filtering

Burr inspection for washers

OK product

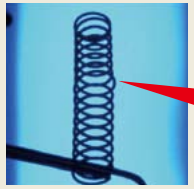
NG product

Flaw inspection for bearings

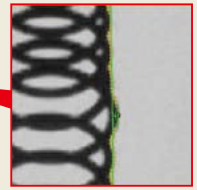
NG product

Magnified image

Spring forming inspection



NG product



Magnified image

Position/Angle

Speedometer inspection

OK product

NG product

O-ring position inspection

OK product

NG product

Food/Pharmaceuticals/Packaging

Presence/Discrimination

Presence inspection for instant noodle ingredients

OK product

NG product

Verification of cap type

OK product

NG product

Stain/Flaw

Appearance inspection for caps

OK product

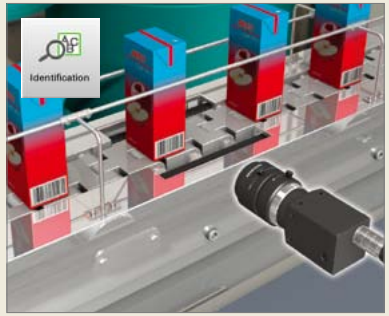
NG product

Glass bottle sealing surface inspection

NG product

Identification

Barcode reading for paper packaging



OK product

NG product

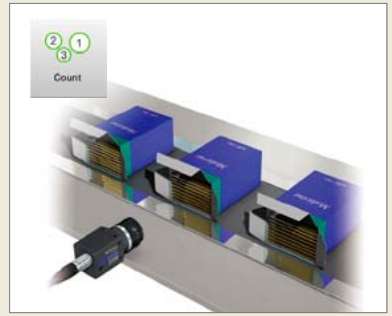
Text recognition of expiration date

OK product

NG product

Count

Product counting



OK product

NG product

Position/Angle

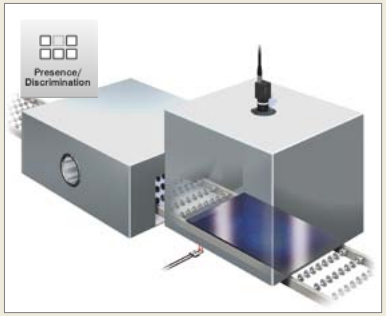
Positioning inspection for labels

OK product

NG product

Presence/Discrimination

Solar cell color inspection

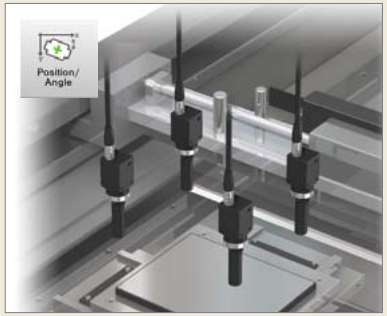


OK product

NG product

Position/Angle

Glass substrate alignment



Before alignment

After alignment

Dimensions/Geometry

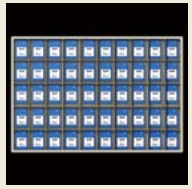
IC lead inspection

NG product

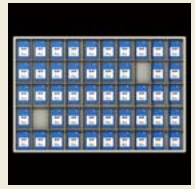
Magnified image

Count

SD card counting



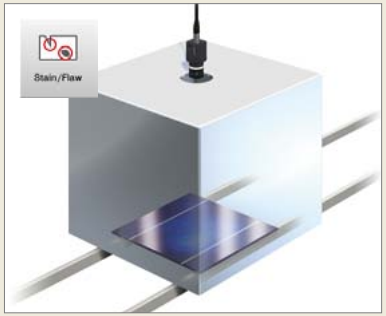
OK product

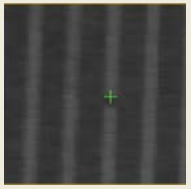


NG product

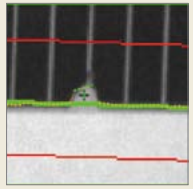
Stain/Flaw

Quality inspection on solar cells





Cuts on electrode printing



Chipped edge

Position/Angle

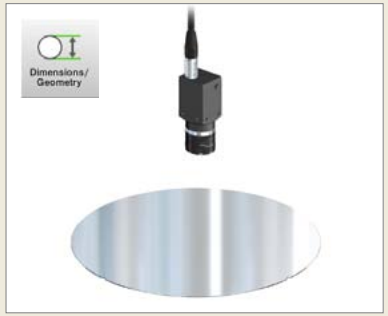
Solar cell alignment

Before alignment

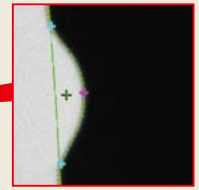
After alignment

Dimensions/Geometry

Wafer alignment



Full image



Magnified image

Identification

2D code reading on a mold

OK product

NG product

Rich interface to enhance compatibility with external devices

Removable SD cards

There are two SD card slots that support SDHC cards up to 4 GB* for a total of 8 GB of storage. This makes it possible to save large amount of data and images.

* Guaranteed only with KEYENCE SD cards

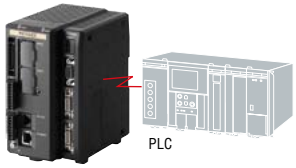
Illumination expansion unit

Connects the CA-DC21E illumination expansion unit

Illumination expansion unit
CA-DC21E

Ethernet communiction methods

Supports Ethernet TCP/IP, EtherNet/IP, PROFINET, and PLC-Link.



PLC

Camera port

Quick, easy connection of camera with quick disconnect camera cables. Max length up to 51 m 167.3'.

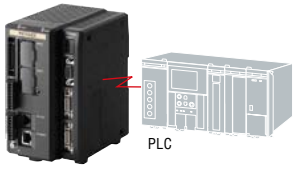
Camera expansion unit

Connect the CV-E500 camera expansion unit when using 3 or 4 cameras.

Camera expansion unit
CV-E500

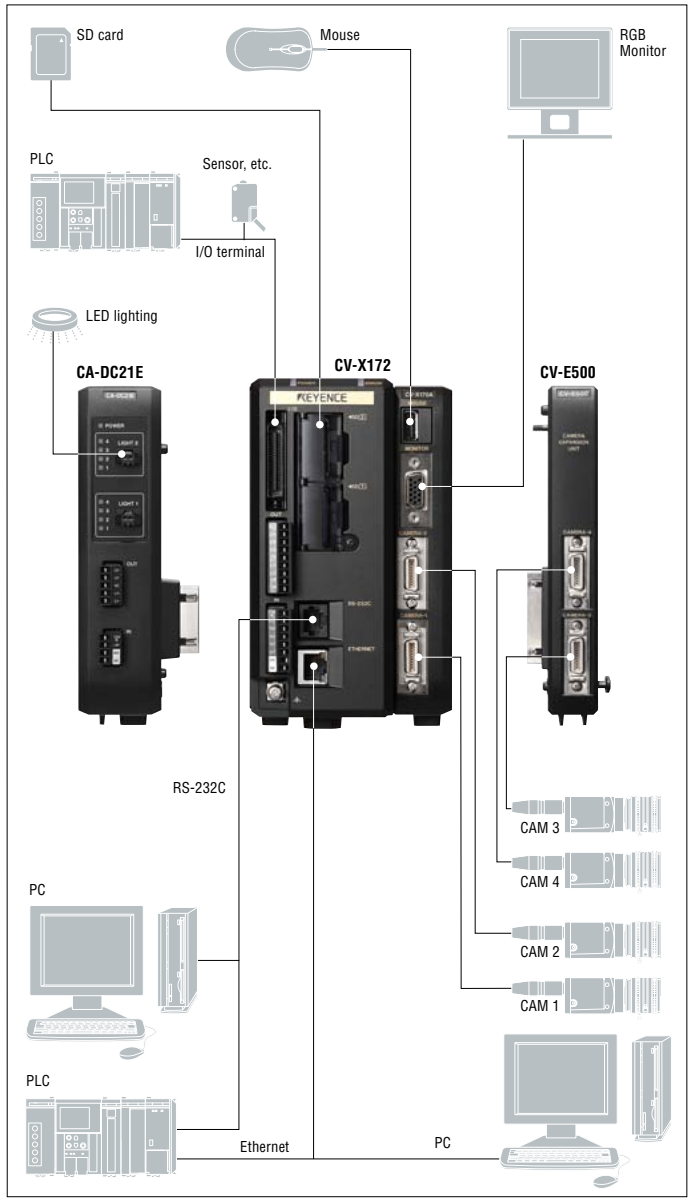
RS-232C communication

RS-232C communication allows direct serial connection with different devices.



PLC

System Configuration



Controller

Supports 5 megapixel cameras
Ultra high-speed, high-capacity type
CV-X172

Supports 2 megapixel cameras High-speed type
CV-X152

For 310,000 pixels only
CV-X102

Camera expansion unit
CV-E500

Illumination expansion unit
CA-DC21E

Accessories

Mouse (Accessory)

PC software DVD-ROM
CV-H1X (Accessory)

Windows XP (Professional/Home Edition SP2 or later)

Windows Vista (Enterprise/Ultimate/Business/Home Premium/ Home Basic)

Windows 7 (Home Premium/Professional/Ultimate/Enterprise)

Supported OS languages: English, Japanese, Chinese (Simplified and Traditional), Korean, Thai, German, French, Italian, and Spanish

Supports the 64-bit version for Microsoft Windows 7 only. For all other operating systems, only the 32-bit version is supported.

Monitor

XGA monitor
CA-MP120

Monitor stand for CA-MP120
OP-87262

RGB monitor cable
OP-66842 (3 m 9.8')
OP-87055 (10 m 32.8')

Communication cable

Extension I/O cable
OP-51657 (3 m 9.8')

Communication cable conversion connector
For 9-pin **OP-26486**
For 25-pin **OP-26485**
For 9-pin SYSMAC **OP-84384**
For 9-pin MELSEC **OP-86930**
For 9-pin MELSEC FX **OP-26486**

RS-232C communication cable
OP-26487 (2.5 m 8.2')

Ethernet cable
OP-66843 (3 m 9.8')

Other

Dedicated 24 VDC power source
CA-U3

Mouse stand
OP-87601

SD card (industrial-grade)
4 GB **CA-SD4G** (SDHC)
1 GB **CA-SD1G**
512 MB **OP-87133**

Camera mounting stage
CA-S2040

Area camera

11x
5 megapixel camera
CV-H500C (Color)
CV-H500M (Monochrome)

7x
2 megapixel camera
CV-H200C (Color)
CV-H200M (Monochrome)

7x
310,000 pixel camera
CV-H035C (Color)
CV-H035M (Monochrome)

2 megapixel camera
CV-200C (Color)
CV-200M (Monochrome)

310,000 pixel camera
CV-035C (Color)
CV-035M (Monochrome)

Ultra-compact camera
2 megapixel camera
CV-S200C (Color)
CV-S200M (Monochrome)

Ultra-compact camera
310,000 pixel
CV-S035C (Color)
CV-S035M (Monochrome)

Optional accessories

Camera cable

L-type connector

[List of models]

Cable type	Connector shape	Cable length					
		1 m 3.3'	3 m 9.8'	5 m 16.4'	10 m 32.8'	17 m 55.8'	Extension cable
Standard	Straight	**CA-CN1**	**CA-CN3**	**CA-CN5**	**CA-CN10**	**CA-CN17**	—
	L-type	—	**CA-CN3L**	**CA-CN5L**	**CA-CN10L**	**CA-CN17L**	—
High-flex cable	Straight	—	**CA-CN3R**	**CA-CN5R**	**CA-CN10R**	**CA-CN17R**	**CA-CN7RE** (7 m 23.0')
For high-speed camera	Straight	—	**CA-CH3**	**CA-CH5**	**CA-CH10**	—	—
	L-type	—	**CA-CH3L**	**CA-CH5L**	**CA-CH10L**	—	—
High-flex for high-speed camera	Straight	—	**CA-CH3R**	**CA-CH5R**	**CA-CH10R**	—	—

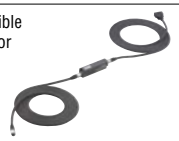
Camera Cable Compatibility List

Connectable cameras / Number of pixels		Area Camera			
		5 megapixel	2 megapixel	1 megapixel	310,000 pixels
For high-speed camera	**CA-CH10**	X	X	X	X
	CA-CH5	X	X	X	X
	CA-CH3	X	X	X	X
For normal cameras	**CA-CN17**	-	-	-	X
	CA-CN10	-	X	-	X
	CA-CN5	-	X	-	X
	CA-CN3	-	X	-	X
	CA-CN1	-	X	-	X

Repeater for camera cable extension
CA-CNX10U
(for normal cameras)
CA-CHX10U
(for high-speed cameras)

Camera cable extension is possible at a max length of 51 m 167.3' or 30 m 98.4'*.

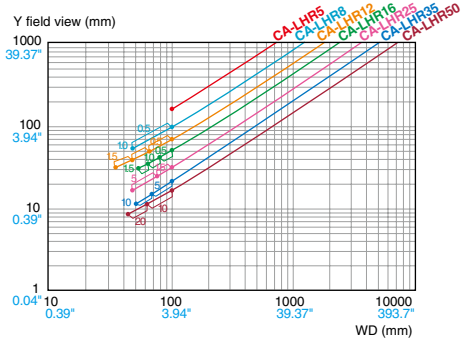
* The maximum length will differ according to the camera model. Contact KEYENCE for details.



A dedicated extension cable is required for repeater ⇔ camera or repeater ⇔ repeater. Contact KEYENCE for details.

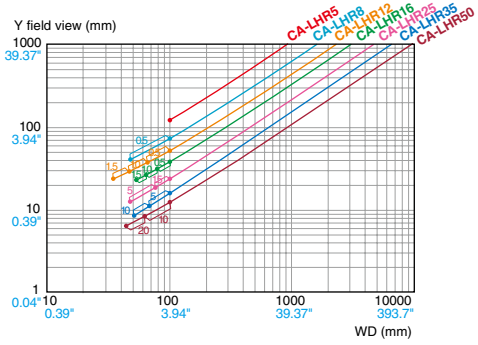
* Microsoft and Windows are the registered trademark or trademark of the Microsoft Corporation in the United States and/or other countries.

CV-H500C/CV-H500M
(When the CA-LHR Series is equipped)



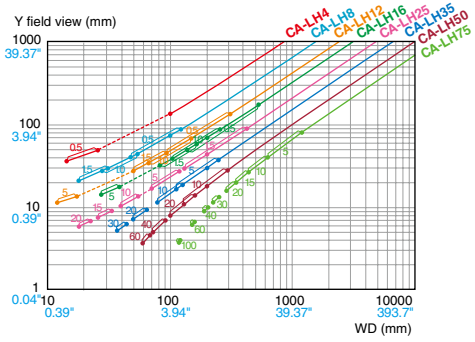
* Using close-up rings may reduce the accuracy of the periphery image.

CV-200C/CV-200M/CV-H200C/CV-H200M
(When the CA-LHR Series is equipped)

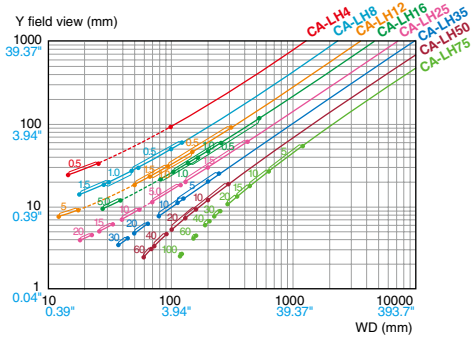


* Using close-up rings may reduce the accuracy of the periphery image.

CV-200C/CV-200M/CV-H200C/CV-H200M
(When the CA-LH Series is equipped)

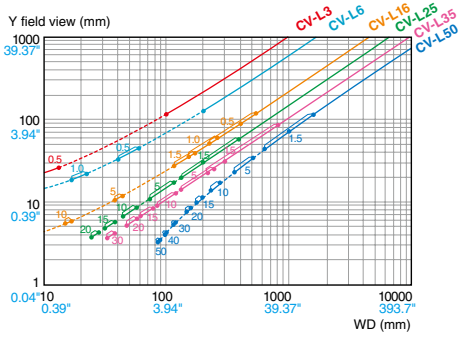


CV-035C/CV-035M/CV-H035C/CV-H035M
(When the CA-LH Series is equipped)

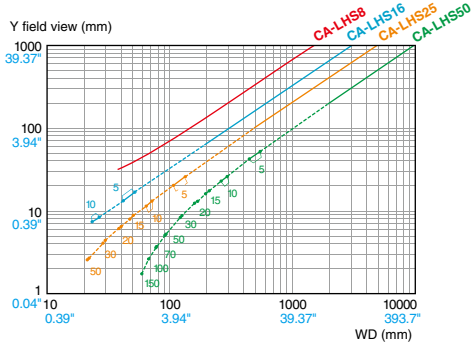


1/3" 640 x 480
(When the CV-035C/M or CV-H035C/M is equipped)

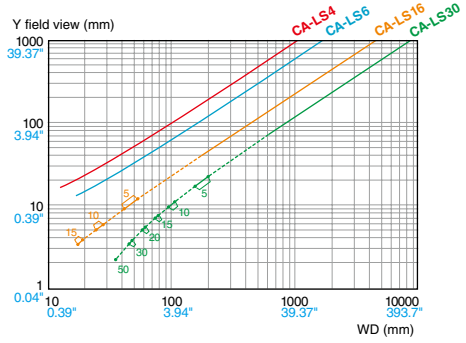
CV-035C/CV-035M/CV-H035C/CV-H035M
(When the CV-L Series is equipped)



CV-S200C/CV-S200M
(When the CA-LHS Series is equipped)



CV-S035C/CV-S035M
(When the CA-LS Series is equipped)



The numerical values in these graphs are just reference values.
Therefore, adjustment may be necessary when installation is performed.

Controller model*1*2			CV-X172	CV-X152	CV-X102
Number of pixels			With CV-H500C/H500M connected • 5,000,000-pixel mode: 2432 (H) x 2050 (V), approx. 4.99 megapixel With CV-200C/S200C/H200C/200M/S200M/H200M connected • 2,000,000-pixel mode: 1600 (H) x 1200 (V), 1.92 megapixel • 1,000,000-pixel mode: 1024 (H) x 960 (V), approx. 980,000 pixels With CV-035C/S035C/035M/S035M/H035C/H035M connected • 310,000-pixel mode: 640 (H) x 480 (V), approx. 310,000 pixels • 240,000-pixel mode: 512 (H) x 480 (V), approx. 240,000 pixels	With CV-200C/S200C/H200C/200M/S200M/H200M connected • 2,000,000-pixel mode: 1600 (H) x 1200 (V), 1.92 megapixel • 1,000,000-pixel mode: 1024 (H) x 960 (V), approx. 980,000 pixels With CV-035C/S035C/035M/S035M/H035C/H035M connected • 310,000-pixel mode: 640 (H) x 480 (V), approx. 310,000 pixels • 240,000-pixel mode: 512 (H) x 480 (V), approx. 240,000 pixels	• 310,000-pixel mode: 640 (H) x 480 (V), approx. 310,000 pixels • 240,000-pixel mode: 512 (H) x 480 (V), approx. 240,000 pixels
Camera input			2 Color/monochrome cameras (Supports CV-H500C/200C/S200C/H200C/035C/S035C/H035C/H500M/200M/S200M/H200M/035M/S035M/H035M, mixed connection possible)	2 Color/monochrome cameras (Supports CV-200C/S200C/H200C/035C/S035C/H035C/200M/S200M/H200M/035M/S035M/H035M, mixed connection possible)	2 Color/monochrome cameras (Supports CV-035C/S035C/H035C/035M/S035M/H035M, mixed connection possible)
	Number of connected units		Supports 2 camera expansion and simultaneous capture with up to 4 cameras via connection with the CV-E500 expansion unit		Simultaneous/individual capture with 2 cameras is possible
Main processor for image processing			DSP (High-Speed)	DSP (Medium)	DSP (Standard)
Number of setting registrations			Up to 1000 settings (depending on SD card capacity and setting contents) for SD card 1 and SD card 2 individually and external switching is possible		
Number of reference images			Each setting supports 900 images per camera (depending on SD card capacity), compress and save functions and image registration of position adjusted images.		
Memory card			• SD card slot x2 (SDHC compatible) • Supports OP-87133 (512 MB: standard equipment on the SD1 slot for the CV-X152/X102), CA-SD1G (1 GB: standard equipment on the SD1 slot for the CV-X172), CA-SD4G (4 GB)		
Camera Settings			• Shutter speed adjustment • Sensitivity adjustment (1.0 to 9.0)		
	Trigger		• Supports external triggers (TRG1 to 4) and internal triggers • Supports pre-capture • Supports trigger delays for each camera • Supports random triggers		
	Capture area settings	Processing area setting function	• Possible to specify a 980,000-pixel area (1024 (H) x 960 (V)) in any position as the image processing area within 1,920,000 pixels (1,000,000-pixel mode) • Possible to specify a 240,000-pixel area (512 (H) x 480 (V)) in any position as the image processing area within 320,000 pixels * (standard mode) * 310,000 pixels when CV-H035C/H035M is connected		• Possible to specify a 240,000-pixel area (512 (H) x 480 (V)) in any position as the image processing area within 320,000 pixels * * 310,000 pixels when CV-H035C/H035M is connected
		Scanning method (only when a monochrome camera is connected)	Selectable between progressive/interlace		
		Capture start/end line setting function	• Can set an arbitrary capture start/end line within the image capture range. (The CV-H200C and H200M do not allow less than 100 lines to be captured)		
	Calibration		• Corrects lens and perspective distortion on the current image through calibration using calibration patterns (only when a monochrome camera is connected and in progressive mode) • Possible to print calibration patterns.		
	HDR		Possible to improve the problems of blocked up shadows and blown out highlights, adjust brightness and contrast, and support multiple image capture		
	Multiple image capture		Up to 8 images		
	Gain adjustment		Offset (-255 to +255), Span adjustment (0.0 to 7.9)		
	White balance		Manual setting with white target		
	Lighting		Capable of lighting and adjustment to light intensity for each camera (When using the CA-DC21E)		
Number of tools that can be set			Up to 100 for each camera		
Tools	Common specifications	Inspection region (Supported regions will differ depending on the tool)	• Shapes include: rectangle, rotated rectangle, circle, oval, ring, arc, and polygon (up to 12 angles) • 4 regions per tool can be set for the mask region		

Controller model*1*2			CV-X172	CV-X152	CV-X102
Tools	Common specifications	Image enhance (will be varied depending on the tool)	• Types: expand, shrink, remove bright noise, remove dark noise, average, median, sharpen, sobel X, sobel Y, sobel, prewitt, roberts, laplacian, binary (only for area and blob), subtraction, preserve intensity, contrast conversion, image extraction, shading correction, blur • Count: Repetition of the same type (up to 9 times) (only once for binary, subtraction, preserve intensity, contrast conversion, Image extraction, shading correction, and blur), 13 levels (for binary and subtraction, 1 level per tool)		
		Extract colors (Only with Color camera connected)	• Color to binary, color to grayscale, fine color, gray (Color corresponds to numeric value specified by HSV values, fine color can be selected only for stain tool)		
		Display options	• Edge graph, detect position, detect edge (profile, segment, connector dimension graph), pattern region, registered feature, input feature, dimension line display • Supports line thickness and color settings		
		Origin coordinates	Origin coordinate, detection point		
	Presence/Discrimination		Auto-teach, black/white-specific area, color-specific area, shading pattern, shading, color component		
	Stain/Flaw		Auto-teach, total stain area, each stain, black & white area, flaw on a line, flaw on a ring, flaw on a curve		
	Position/Angle		Shading pattern position, edge position, position and angle of line, center position of circle, edge slope, edge position to circumference, tip position, cluster position		
	Dimensions/Geometry	Measure distance	Points distance, point/Line distance, lines distance, point/circle distance, line/circle distance, circles distance		
		Measure width	Edge width, width (max./min.), diameter (max./min.), center pitch, gap pitch, gap pitch (edge pairs), points distance, peak-to-peak width		
		Line/Angle	Line along with profile, line passing two points, bisection of two lines, angle formed by two lines		
		Intersection/Center	Line/v-line intersection, two lines intersection, center of quadrangle, midpoint of points		
		Detect circle	Circle along with profile, circle passing three points		
		Detect point	Shading pattern position, edge position, tip position, gravity center of cluster		
	Count		Cluster, edge, shading pattern		
	Identification		Characters, 1D code, 2D code		
	Graphic display		Line display, circle display, point display, scale display		
	Mathematical Operations		• Sets multiple calculation formulas with line breaks and up to 5000 characters can be entered directly with support for comment entry • Supports time-out settings • Mathematical operator, logic operator, comparison operator, mathematical function, trigonometric function, geometric function, calendar function, bit function, statement • Supports judgment through answers ANS0, ANS1, ANS2 • Supports display of calculation formula errors • Supports temporary variables		
	Connector		Dimension inspection, appearance inspection (Area), appearance inspection (Intensity), appearance inspection (Stain), appearance inspection (Blob), appearance inspection (trend edge position), appearance inspection (trend edge width) and position adjustment		
	Function List		Auto-Teach inspection (pattern search), area, pattern search, edge position, edge angle, edge width, edge pitch, edge pairs, stain, blob, trend edge position, trend edge width, trend edge stain, intensity, inspect colors, OCR, 1D code reader, 2D code reader		
	Position Adjustment		Connector position, shading pattern position, edge position, line position and angle, center of circle, gravity center of cluster		
Utility	Scaling		• Can set correction values for each camera • Can select to turn correction ON/OFF for each tool		
	Operation screen settings		• 10 Operation screen/1 inspection setting • Supports selection from the template catalog • Supports automatic addition of measurement results		
	Archived image settings		• Can store the image amounts listed below as an archive to the image memory for the main unit • Supports two archive conditions: auto, total status NG		
		Archive condition (automatic)	• Max. 506 images (Monochrome camera, 240,000 pixels) • Max. 250 images (Monochrome camera, 310,000 pixels) • Max. 122 images (Monochrome camera, 1,000,000 pixels) • Max. 58 images (Monochrome camera, 2,000,000 pixels) • Max. 19 images (Monochrome camera, 5,000,000 pixels) • Max. 501 images (Color camera, 240,000 pixels) • Max. 247 images (Color camera, 310,000 pixels) • Max. 117 images (Color camera, 1,000,000 pixels) • Max. 54 images (Color camera, 2,000,000 pixels) • Max. 15 images (Color camera, 5,000,000 pixels)	• Max. 250 images (Monochrome camera, 240,000 pixels) • Max. 122 images (Monochrome camera, 310,000 pixels) • Max. 58 images (Monochrome camera, 1,000,000 pixels) • Max. 26 images (Monochrome camera, 2,000,000 pixels) • Max. 245 images (Color camera, 240,000 pixels) • Max. 119 images (Color camera, 310,000 pixels) • Max. 53 images (Color camera, 1,000,000 pixels) • Max. 22 images (Color camera, 2,000,000 pixels)	• Max. 250 images (Monochrome camera, 240,000 pixels) • Max. 122 images (Monochrome camera, 310,000 pixels) • Max. 245 images (Color camera, 240,000 pixels) • Max. 119 images (Color camera, 310,000 pixels)

Continued from pg. 31

Controller model*1*2			CV-X172	CV-X152	CV-X102
Utility	Archived image settings	Archive condition (total status NG)	• Max. 1001 images (Monochrome camera, 240,000 pixels) • Max. 489 images (Monochrome camera, 310,000 pixels) • Max. 105 images (Monochrome camera, 2,000,000 pixels) • Max. 35 images (Monochrome camera, 5,000,000 pixels) • Max. 992 images (Color camera, 240,000 pixels) • Max. 484 images (Color camera, 310,000 pixels) • Max. 97 images (Color camera, 2,000,000 pixels) • Max. 27 images (Color camera, 5,000,000 pixels)	• Max. 489 images (Monochrome camera, 240,000 pixels) • Max. 233 images (Monochrome camera, 310,000 pixels) • Max. 46 images (Monochrome camera, 2,000,000 pixels) • Max. 480 images (Color camera, 240,000 pixels) • Max. 228 images (Color camera, 310,000 pixels) • Max. 39 images (Color camera, 2,000,000 pixels)	• Max. 489 images (Monochrome camera, 240,000 pixels) • Max. 233 images (Monochrome camera, 310,000 pixels) • Max. 480 images (Color camera, 240,000 pixels) • Max. 228 images (Color camera, 310,000 pixels)
			• Supports output of archived image to SD cards, PC program and FTP server • Supports output to folders for each camera • For image output, it is possible to select from three options: always, CAM judgment NG images only, or total status NG only • Supports image output preferred setting		
	Image Strip settings		Supports download of external image files (SD card, FTP)		
	Security settings		• A password between 4 and 32 characters can be set and it is possible to enter capital and lowercase characters as well as numbers and symbols • Supports controller ID lock, and up to 100 controller IDs can be registered		
	Update reference value		Can execute recalculation of the reference values		
	Custom menu		• Max. 100 items per camera • Supports registration by selecting items		
	Connector adjustment menu		Enables component changes for previously set connector tools and provides navigation for product type expansion adjustment procedures		
	Tool Adjustment Navigation		Filters images that should essentially be OK out of those that have been judged as NG to adjust mis-judgment		
	Auto-teach inspection adjustment navigation		Filters images that should essentially be OK out of those that have been judged NG by Auto-Teach Inspection and then teaches these images in addition		
	Camera installation replication		Reproduces the capture environment that existed when the reference image was captured		
	Statistics	Amount of data	Max 20,000 pieces of data per item, max. 128 items (supports batch saving to SD card)		
		Statistical items	Max. value, min. value, average value, deviation (3σ), OK/NG count in total status, yield, process capability index (Cpk, Cpu, Cpl)		
		Type	Measured list, trend graph, histogram, process monitor		
	Batch test		Supports batch test for archived images		
	I/O monitor		• Updates the state of the I/O terminal in real-time • Supports forced output		
	RS-232C monitor		• Updates communication contents in real-time • Supports saving communication logs to SD card		
	EtherNet/IP monitor		• Updates communication contents in real-time • Supports forced output		
	PROFINET monitor		• Updates communication contents in real-time • Supports forced output		
	Change account		Admin/Operator/User		
	Manage files		Supports file control with up to 1024 files		
	Remove SD Card2		Used to eject SD card 2		
	Tolerance overwrite function		The specified Judgment conditions and stain levels can be rewritten during operation.		
	Share judgment condition		Judgment conditions can be shared between tools that have been set (the sharing group has an upper limit of 100 tools).		
	Connector shared data management		Supports copying, deleting, and renaming of shared connector data		
Global settings			• Communications & I/O (network/external terminal/PLC-Link/RS-232C/FTP/VNC/EtherNet/IP and PROFINET) • Camera common (run screen update mode/lighting configuration/white balance settings) • System (controller name/reference image file type/image capture settings/mouse settings/error output settings) • startup mode setting, set account, date & time, language, reboot, system information		
Output settings	Judgment settings		Supports the selection of tools for CAM judgment and partial judgment A max. of 100 groups can be used for partial judgment		
	OR terminal		Supports the selection of terminal output status when outputting total status from the OR terminal		
	OUT terminal		Supports the setting of items output from the parallel I/O connectors (OUT 6 to OUT 21) for tool, intra-tool, partial, and CAM judgment values		
	RS-232C (non-procedural)		Supports the selection of output items when outputting non-procedural results with RS-232C (max. 256 items)		
	Ethernet (non-procedural)		Supports the selection of output items when outputting non-procedural results with Ethernet (max. 256 items)		
	SD card 2		Supports the selection of output items when outputting results to SD card (max. 256 items)		
	PC program		Supports the selection of output items when outputting results to PC program (max. 256 items)		
	PLC-Link		Supports the selection of output items when outputting results with PLC-Link (RS-232C/Ethernet) (max. 256 items)		
	EtherNet/IP		Supports the selection of output items when outputting results with EtherNet/IP (max. 64 items for bit allocation and max. 256 items for byte allocation)		
	PROFINET		Supports the selection of output items when outputting results with PROFINET (max. 64 items for bit allocation and max. 256 items for byte allocation)		
	FTP		Supports the selection of output items when outputting results to an FTP server (max. 256 items)		
	Image output		Supports settings for image output to PC program, FTP servers or SD card		
Support functions	Setting auxiliary functions	Screen display	Possible within a range of 4% to 2500% when operating, the display position the measurement position (Individual zoom settings are possible when displaying multiple screens)		
		Edge differential Display waveform	Can display edge differentiated waveform graphics with measurement values during operation		
		Profile Display	Can display all detect position graphics for trend edge position and width during operation		
		Contrast	Can display graphics for stain detection (stain level) during operation		

Controller model*1*2			CV-X172	CV-X152	CV-X102
Support functions	Setting assist functions	Cutout projection Waveform display	OCR automatic cutout projection waveform graphics can be displayed during operation		
		Defect level Waveform display	The stain level wave of trend edge stain can be displayed during operation		
	SD card saving function		Supports measured values, judgment results, measurement images (can be compressed), archived images (can be compressed), captured images, statistics data, RS-232C communication logs, and setting contents, direct saving during inspection operations (not including setting contents programs)		
	Context menu		Image capture function, change user account function, reset, remove SD Card 2		
Interface	Control input	External Trigger Input	4 points (2 of which support special function assignment) Input rating: 26.4 V max., 3 mA min, can select from simultaneous/individual capture with up to 4 cameras (While the CV-E500 is disconnected, simultaneous capture is performed with up to 2 cameras in total)	4 points (2 of which support special function assignment) Input rating: 26.4 V max., 3 mA min, can select from simultaneous/individual capture with up to 4 cameras (While the CV-E500 is disconnected, simultaneous capture is performed with up to 2 cameras in total)	4 points (2 of which support special function assignment) Input rating: 26.4 V max., 3 mA min., simultaneous/individual capture with up to 2 cameras is possible
			Can set individual trigger delays (0 to 999 ms) for each trigger input		
		Control input	16 points (4 of which support special function assignment) Input rating: 26.4 V max., 2 mA min.		
	Control output	Common output	27 points (10 of which support special function assignment, includes 4 high speed outputs), NPN open collector, 50 mA max. (30 V max.), the high-speed output terminal is 3 mA min. *2		
		Total status output	1 point, NPN open collector, 50 mA max. (30 V max.) Supports total status hold control, one-shot output (1 to 9999 ms)		
	Monitor output		Analog RGB output XGA 1024 × 768 (24bit color, 60 Hz)		
	Operation indicator		Power ERROR LED display		
	RS-232C		Can perform numerical value output and control I/O, supports a max. baud rate of up to 115200 bps (Cannot be used with PLC-Links using the RS-232C port)		
	PLC-Link		• Can output numerical values and perform control input/output using the Ethernet or RS-232C port (Cannot be used in conjunction with EtherNet/IP / PROFINET. Cannot be used in conjunction with non-procedural RS-232C communication when using the RS-232C port.) • The following PLCs are supported via link unit: *3 KEYENCE: KV-700 Series, KV-1000 Series, KV-3000 Series, KV-5000 Series, KV-5500 Series Mitsubishi Electric: MELSEC A Series (RS-232C only), Q Series, L Series, FX Series (RS-232C only) OMRON: SYSMAC C Series (RS-232C only), CJ/CS1/CP1 Series YASKAWA Electric Corporation: MP900 Series (RS-232C only)/MP2000 Series		
	Ethernet		• Can output numerical values and perform control input/output • Can output measured value and image data via the included PC program • Supports FTP client and FTP server • VNC server (for non-PC clients, only displaying the monitor screen is supported) • 1000BASE-T/100BASE-TX/10BASE-T		
	EtherNet/IP		• Numerical value and control input/output using the Ethernet port enabled (Cannot be used in conjunction with PLC-link / PROFINET). • Cyclic (implicit) communication (max. 1436 bytes) possible. Message communication possible. • Maximum connections: 32. • In conformity with conformance test Version.A9.		
	PROFINET		• Numerical value and control input/output using the Ethernet port enabled (Cannot be used in conjunction with PLC-link / EtherNet/IP). • Cyclic communication (max. 1408 bytes) possible. Record data communication possible. • In conformity with Conformance Class A.		
	Mouse		Possible to control various menus via a dedicated mouse (OP-87506: included with the controller)		
Illumination control			By connecting the optional Illumination Expansion Unit CA-DC21E, lighting and intensity for the LED illumination (12 V, 24 V) is possible. 2ch/unit, up to 4 units can be connected		
Language			English, Japanese, Simplified Chinese, Traditional Chinese, Korean, Thai, German, French, Italian, and Spanish (Mexican)		
Rating	Voltage		24 VDC ±10%		
	Consumption current		2.8 A (2 cameras)/ 3.1 A (4 cameras) Includes 1 A rush current during start up When a repeater is connected, this is increased by 0.3 A for every 2 cameras	2.5 A (2 cameras)/ 2.8 A (4 cameras) Includes 1 A rush current during start up When a repeater is connected, this is increased by 0.3 A for every 2 cameras	1.9 A (2 cameras) Includes 1 A rush current during start up When a repeater is connected, this is increased by 0.3 A for every 2 cameras
Environmental resistance	Operating ambient temperature		• When 2 cameras are connected: 0 to +50°C 32 to +122°F • When 4 cameras are connected: 0 to +45°C 32 to +113°F		0 to +50°C 32 to +122°F
	Operating ambient humidity		35 to 85% RH (No condensation)		
Weight			Approx. 1250 g		

*1 The letters that follow the model numbers, such as F/A/M, describe differences in the software. For details, see the user manual for the CV-X100 Series.

*2 Controllers with a P suffix in the part number have PNP open collector type outputs.

*3 Models that are equipped with an Ethernet port on the CPU unit support direct connection with the Ethernet port.

Camera (CV-H500C/CV-H500M/CV-H200C/CV-H200M)

Model		Camera unit (**CV-H500C/CV-H500M**) *4	Camera unit (**CV-H200C/CV-H200M**) *4
Image element		2/3-inch color CCD image receiving element, 11x high-speed reading using square-pixel, 5.05 megapixel (CV-H500C) 2/3-inch monochrome CCD image receiving element, 11x high-speed reading using square-pixel, 5.05 megapixel (CV-H500M) Unit cell size: 3.45 µm x 3.45 µm 0.14 Mil x 0.14 Mil	1/1.8-inch color CCD image receiving element, 7x high-speed reading using square-pixel, 2.01 megapixel (CV-H200C) 1/1.8-inch monochrome CCD image receiving element, 7x high-speed reading using square-pixel, 2.01 megapixel (CV-H200M) Unit cell size: 4.4 µm x 4.4 µm 0.17 Mil x 0.17 Mil
Number of effective pixels		4.99 megapixel 2432 (H) x 2050 (V)	1.92 megapixel 1600 (H) x 1200 (V) *5
Scanning system		Progressive (61.2 ms) Interlace: CV-H500M only (40.3 ms)	Progressive (29.2 ms: 2 megapixel mode, 24.2 ms: 1 megapixel mode) Interlace: CV-H200M only (16.1 ms: 2 megapixel mode, 13.6 ms: 1 megapixel mode)
Pixel transfer frequency		130 MHz (65 MHz x 2ch)	82 MHz (41 MHz x 2ch)
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens Mounts		C Mount	
Environmental resistance	**Operating ambient temperature**	0 to +40°C 32 to +104°F	
	Operating ambient humidity	35 to 85% RH (No condensation)	
Weight		Approx. 130 g (not including lens)	

*4 Only the high-speed camera cable can be used for the camera cable.
*5 When in 1 megapixel mode, the processing area is 980,000 pixels (1024 x 960).

Camera (CV-H035C/CV-H035M)

Model		Camera unit (**CV-H035C/CV-H035M**) *6
Image element		1/3-inch color CCD image receiving element, 7x high-speed reading using square-pixel, 340,000 pixels (CV-H035C) 1/3-inch monochrome CCD image receiving element, 7x high-speed reading using square-pixel, 340,000 pixels (CV-H035M) Unit cell size: 7.4 µm x 7.4 µm 0.29 Mil x 0.29 Mil
Number of effective pixels		310,000 pixels 640 (H) x 480 (V) *7
Scanning system		Progressive (4.7 ms) Interlace: CV-H035M only (2.5 ms)
Pixel transfer frequency		80 MHz (40 MHz x 2ch)
Transfer system		Digital serial transfer
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000
Lens Mounts		C Mount
Environmental resistance	**Operating ambient temperature**	0 to +40°C 32 to +104°F
	Operating ambient humidity	35 to 85% RH (No condensation)
Weight		Approx. 120g (not including lens)

*6 Only the high-speed camera cable can be used for the camera cable.
*7 When in 310,000 pixel mode, the processing area is 310,000 pixels (640 x 480). When in 240,000 pixel mode, the processing area is 240,000 pixels (512 x 480).

Camera (CV-200C/CV-200M/CV-S200C/CV-S200M)

Model		Camera unit (**CV-200C/CV-200M**) *8	Camera unit (**CV-S200C/CV-S200M**) *8
Image element		1/1.8-inch color CCD image receiving element, reading using square-pixel, 2.01 megapixel (CV-200C) 1/1.8-inch monochrome CCD image receiving element, reading using square-pixel, 2.01 megapixel (CV-200M) Unit cell size: 4.4 µm x 4.4 µm 0.17 Mil x 0.17 Mil	1/1.8-inch color CCD image receiving element, reading using square-pixel, 2.01 megapixel (CV-S200C) 1/1.8-inch monochrome CCD image receiving element, reading using square-pixel, 2.01 megapixel (CV-S200M) Unit cell size: 4.4 µm x 4.4 µm 0.17 Mil x 0.17 Mil
Number of effective pixels		1.92 megapixel 1600 (H) x 1200 (V) *9	
Scanning system		Progressive (58.5 ms: 2 megapixel mode, 47.6 ms: 1 megapixel mode) Interlace: CV-200M only (32.7 ms: 2 megapixel mode, 27.0 ms: 1 megapixel mode)	Progressive (58.5 ms: 2 megapixel mode, 47.6 ms: 1 megapixel mode) Interlace: CV-S200M only (32.7 ms: 2 megapixel mode, 27.0 ms: 1 megapixel mode)
Pixel transfer frequency		40 MHz	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens Mounts		C Mount	Special mount (M15.5 P0.5 male)
Environmental resistance	**Operating ambient temperature**	0 to +40°C 32 to +104°F	Head: 0 to +40, relay unit: 0 to +40°C 32 to +104°F [however, 35°C 95°F max. with partial capturing 50 lines or lower]
	Operating ambient humidity	35 to 85% RH (No condensation)	
Weight		Approx. 110 g (not including lens)	Head: Approx. 210 g (including cable and lens), relay unit: approx. 70 g

*8 Camera cables CA-CN17/L/R (17 m 55.8') and the repeater cables CA-CN17LX/RX (17 m 55.8') cannot be used.
*9 When in 1 megapixel mode, the processing area is 980,000 pixels (1024 x 960).

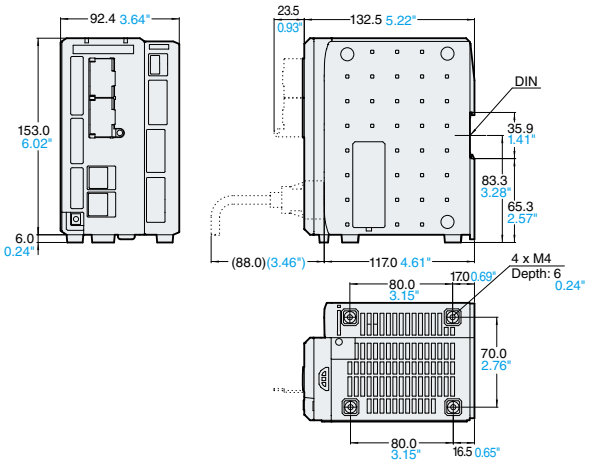
Camera (CV-035C/CV-035M/CV-S035C/CV-S035M)

Model		Camera unit (**CV-035C/CV-035M**)	Camera unit (**CV-S035C/CV-S035M**) *10
Image element		1/3-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 350,000 pixels (CV-035C) 1/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 350,000 pixels (CV-035M) Unit cell size: 7.4 µm x 7.4 µm 0.29 Mil x 0.29 Mil	1/3-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 350,000 pixels (CV-S035C) 1/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 350,000 pixels (CV-S035M) Unit cell size: 7.4 µm x 7.4 µm 0.29 Mil x 0.29 Mil
Number of effective pixels		320,000 pixels 656 (H) x 492 (V) *11	
Scanning system		Progressive (16.0 ms) Interlace: CV-035M only (8.8 ms)	Progressive (16.0 ms) Interlace: CV-S035M only (8.8 ms)
Pixel transfer frequency		24.5 MHz	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens Mounts		C Mount	Special mount (M 10.5, P 0.5, male)
Environmental resistance	**Operating ambient temperature**	0 to +50°C 32 to +122°F	Head: 0 to 50°C 32 to +122°F, relay unit: 0 to 40°C 32 to +104°F
	Operating ambient humidity	35 to 85% RH (No condensation)	
Weight		Approx. 100 g (not including lens)	Head: Approx. 160 g (including cable and lens) Relay unit: Approx. 70 g

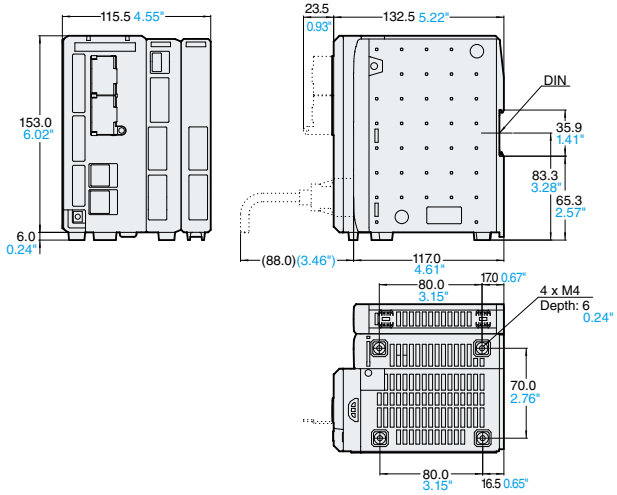
*10 Camera cables CA-CN17/L/R (17 m 55.8') and the repeater cables CA-CN17LX/RX (17 m 55.8') cannot be used.
*11 When in 310,000 pixel mode, the processing area is 310,000 pixels (640 x 480). When in 240,000 pixel mode, the processing area is 240,000 pixels (512 x 480).

Unit: mm inch

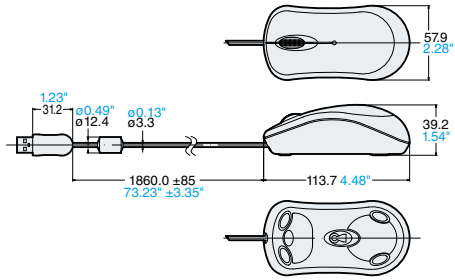
Controller **CV-X172x/CV-X152x/CV-X102x**



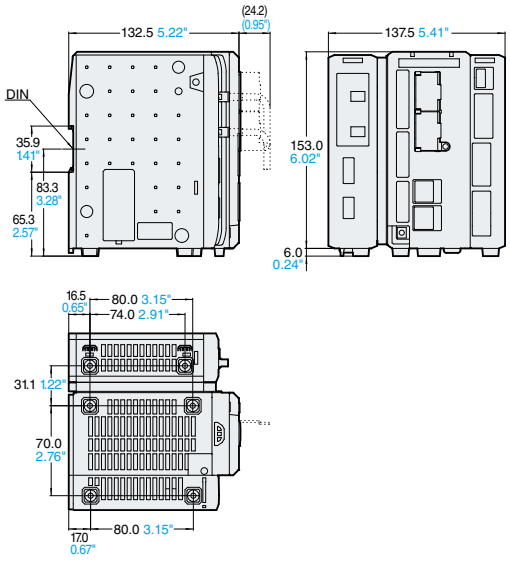
With the camera expansion unit equipped **(CV-X172x/CV-X152x only)**



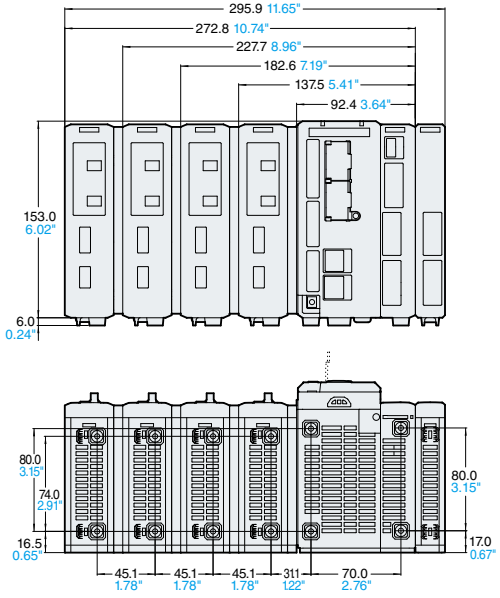
Mouse **OP-87506**



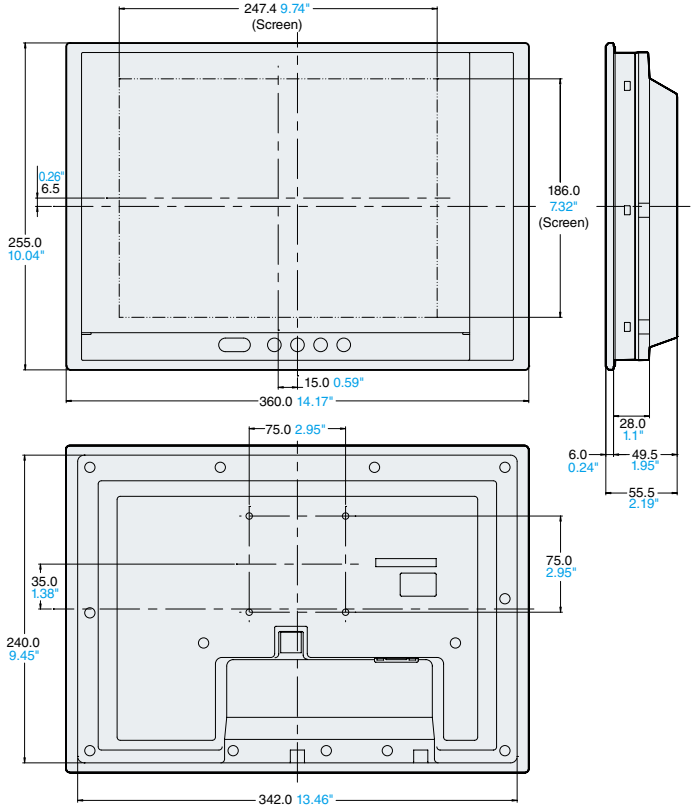
When mounting the illumination expansion unit **CV-X102x+CA-DC21E**



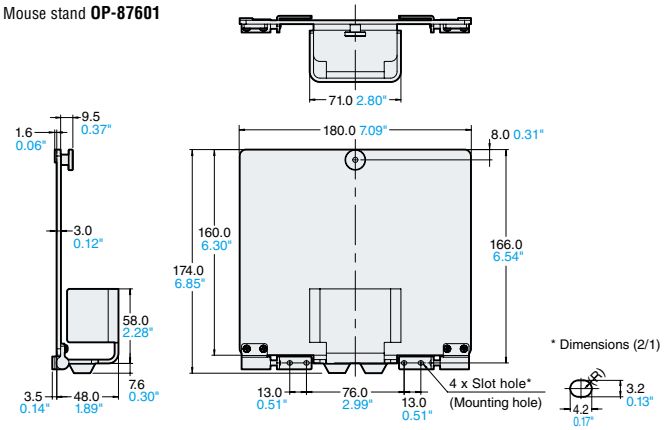
CV-X172x+CV-E500+CA-DC21E (4 units)



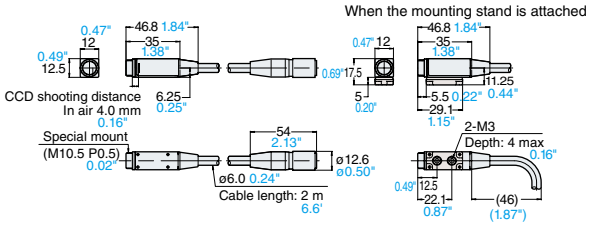
XGA monitor **CA-MP120**



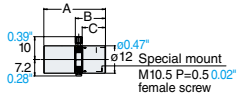
Mouse stand **OP-87601**



Camera **CV-S035CH/CV-S035MH**

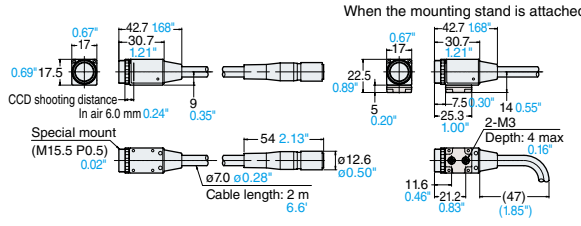


Lens **CA-LSx**

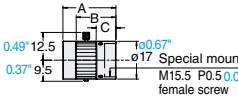


	CA-LS4	CA-LS6	CA-LS16	CA-LS30
A	16.7 0.66"	21.3 0.84"	20.4 0.80"	27 1.06"
B	11.5 0.45"	15.9 0.63"	10.2 0.40"	13.2 0.52"
C	8.5 0.33"	12.9 0.51"	7.2 0.28"	10.2 0.40"

Camera **CV-S200CH/CV-S200MH**

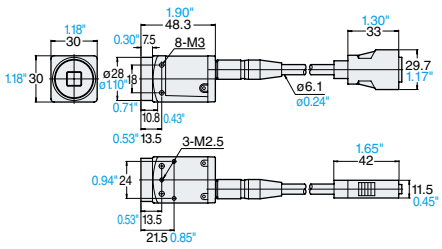


Lens **CA-LHSx**

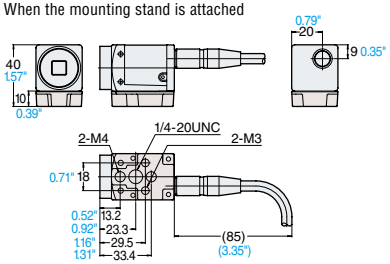


	CA-LHS8	CA-LHS16	CA-LHS25	CA-LHS50
A	40.4 1.59"	23.9 0.94"	24.9 0.98"	40.4 1.59"
B	28.6 1.13"	17.9 0.70"	18.6 0.73"	27.1 1.07"
C	19.6 0.77"	8.9 0.35"	9.6 0.38"	18.1 0.71"

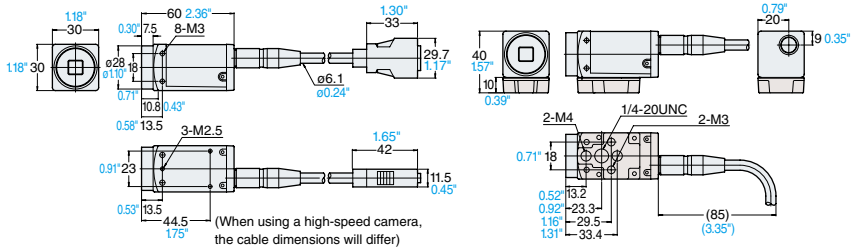
Camera **CV-035C/CV-035M**



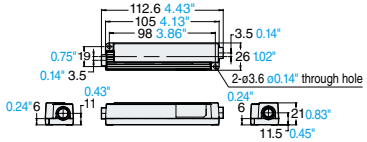
When the mounting stand is attached



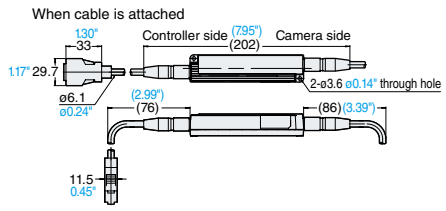
Camera **CV-H500C/CV-H500M/CV-H200C/CV-H200M/CV-200C/CV-200M/CV-H035C/CV-H035M**



Camera control unit **CV-S200CU/CV-S200MU/CV-S035CU/CV-S035MU**



When cable is attached



Camera cable

CA-CN1 (1 m 3.3')/**CA-CN3** (3 m 9.8')/**CA-CN5** (5 m 16.4')/**CA-CN10** (10 m 32.8')/
CA-CN17 (17 m 55.8')

High-flex camera cable

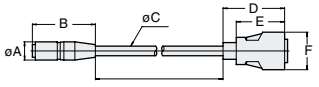
CA-CN3R (3 m 9.8')/**CA-CN5R** (5 m 16.4')/**CA-CN10R** (10 m 32.8')/
CA-CN17R (17 m 55.8')

High-speed camera cable

CA-CH3 (3 m 9.8')/**CA-CH5** (5 m 16.4')/**CA-CH10** (10 m 32.8')

High-flex cable for high-speed cameras

CA-CH3R (3 m 9.8')/**CA-CH5R** (5 m 16.4')/**CA-CH10R** (10 m 32.8')



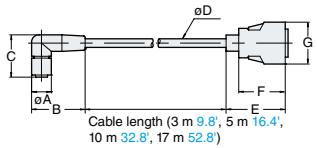
	A	B	C	D	E	F
CA-CNx	12.5 0.49"	43 1.69"	6.1 0.24"	42 1.65"	33 1.30"	29.7 1.17"
CA-CNxR	14.0 0.55"	54 2.13"	6.6 0.26"	42 1.65"	33 1.30"	29.7 1.17"
CA-CHx	12.5 0.49"	43 1.69"	7.2 0.28"	41 1.61"	31 1.22"	31.4 1.24"
CA-CHxR	14.0 0.55"	54 2.13"	7.6 0.30"	41 1.61"	31 1.22"	31.4 1.24"

L-shaped connector camera cable

CA-CN3L (3 m 9.8')/**CA-CN5L** (5 m 16.4')/**CA-CN10L** (10 m 32.8')/
CA-CN17L (17 m 55.8')

L-shaped connector cable for high-speed cameras

CA-CH3L (3 m 9.8')/**CA-CH5L** (5 m 16.4')/**CA-CH10L** (10 m 32.8')



	A	B	C	D	E	F	G
L-shaped connector camera cable **CA-CNxL**	14 0.55"	38 1.50"	30 1.18"	6.1 0.24"	42 1.65"	33 1.30"	29.7 1.17"
L-shaped connector cable for high-speed cameras **CA-CHxL**	14 0.55"	38 1.50"	30 1.18"	7.2 0.28"	41 1.61"	31 1.22"	31.4 1.24"

Please refer to the "Vision System Peripheral Equipment catalog" in regards to any dimensional diagrams for additional devices that have not been included here.

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Please read the instruction manual carefully in order to safely operate any KEYENCE product.

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KA3-1013

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